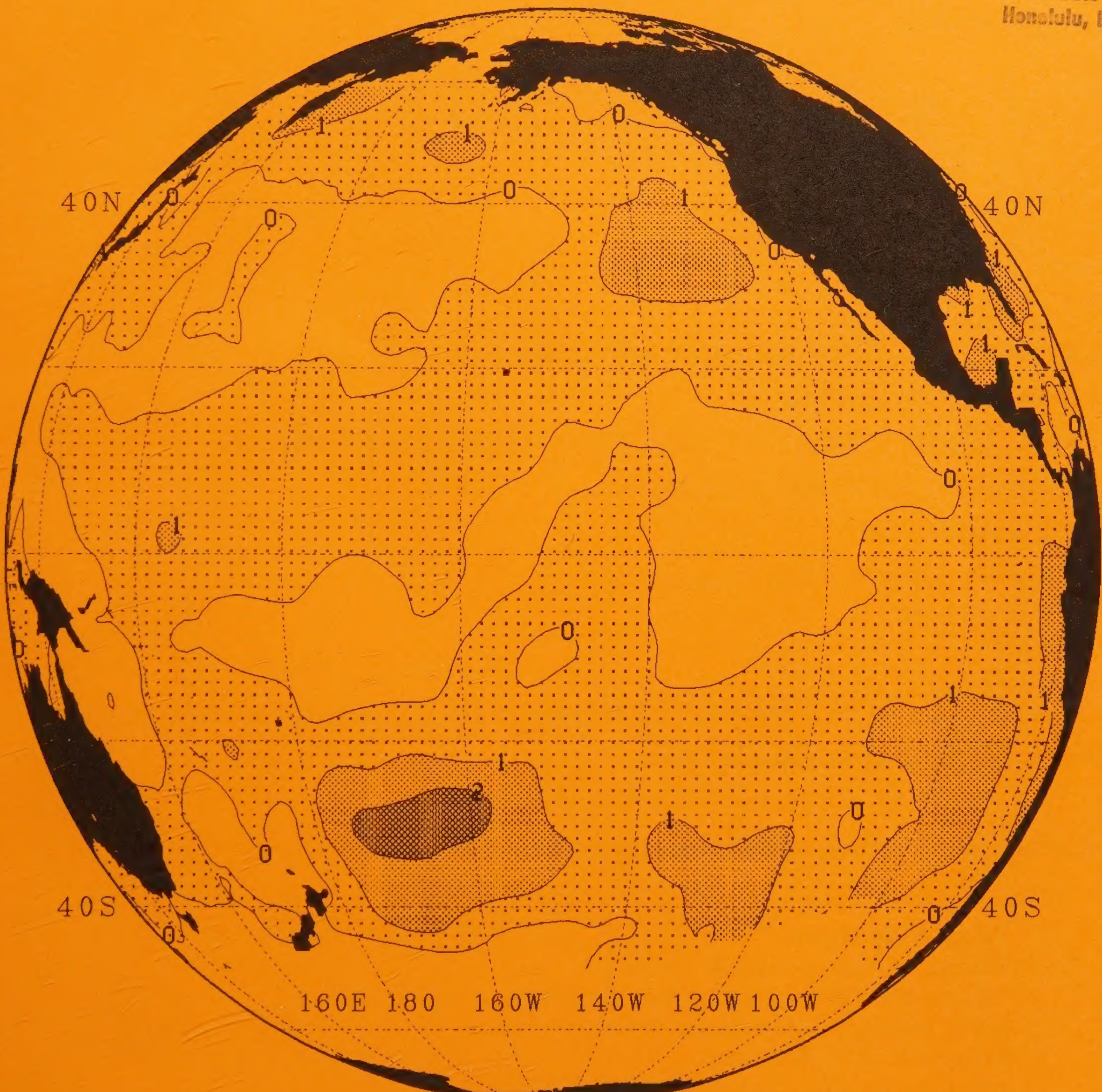
気象庁海洋月報

Monthly Ocean Report

March 1997 (No. 51)

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Climate and Marine Department
Japan Meteorological Agency

気象庁 気候・海洋気象部

平成9年3月

気象庁海洋月報は、気象庁 気候・海洋気象部 海洋課で作成されています。

本月報に関する問い合わせは、

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Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

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表紙は、1997年3月の太平洋の月平均海面水温偏差図です。
陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for March 1997 in the Pacific Ocean.
Areas of positive anomalies are shaded.

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海況の特徴（１９９７年３月）

日本近海の海況

北海道近海から三陸沖にかけての海面水温は負偏差となった。東シナ海、日本海中部、及び四国沖では平年より１℃以上高かった（第４図）。

先月九州南東で発生した小蛇行が東進したため、黒潮は九州から四国沖で離岸した後、室戸岬で接岸して東に流れる流路をとっていた。房総半島沖では離岸して東に流れていた（第9図）。

本州東方の親潮系の冷水は、沿岸寄りの分枝は38゜N,142.1゜Eまで、沖合の分枝は39.8゜N,146゜Eまで、それぞれ達していた（第5図）。

太平洋の海況

太平洋赤道域では、160゜Eから180゜及び100゜W以東の海域で、海面水温が平年より0.5℃以上高かった。特に、170゜E付近と南米沿岸では＋1℃以上の正偏差となった。日付変更線以東の負偏差域は先月より小さくなり、−0.5℃以下の負偏差は見られなくなった。

中部太平洋の30゜Nから40゜Nの175゜Eから155゜Wでは、−0.5℃以下の負偏差となった。アラスカ湾を除く45゜N以北では平年より0.5℃以上高く、30゜Nから40゜Nの150゜W以東では平年より1℃以上高かった（第16図）。

Highlights March 1997

Seas adjacent to Japan

SSTs were below normal around Hokkaido and off Sanriku. Positive SST anomalies more than 1°C were observed in the East China Sea, the central part of the Japan Sea and off Shikoku (Fig. 4).

Because the small meander which occured last month at southeast of Kyushu moved east, the Kuroshio flowed off the coast of Kyushu and Shikoku. After passing near Cape Muroto, it flowed eastward. The Kuroshio flowed eastward off Boso Peninsula (Fig. 9).

Coastal and off-coastal branches of the Oyashio cold water extended southward to 38°N, 142.1°E and 39.8°N, 146°E, respectively (Fig. 5).

Pacific

In the equatorial Pacific, positive SST anomalies more than 0.5°C were observed from 160°E to 180° and east of 100°W. In particular, SSTs are more than 1°C above normal around 170°E and off South America. Negative SST anomalies less than -0.5°C east of the date line were disappeared.

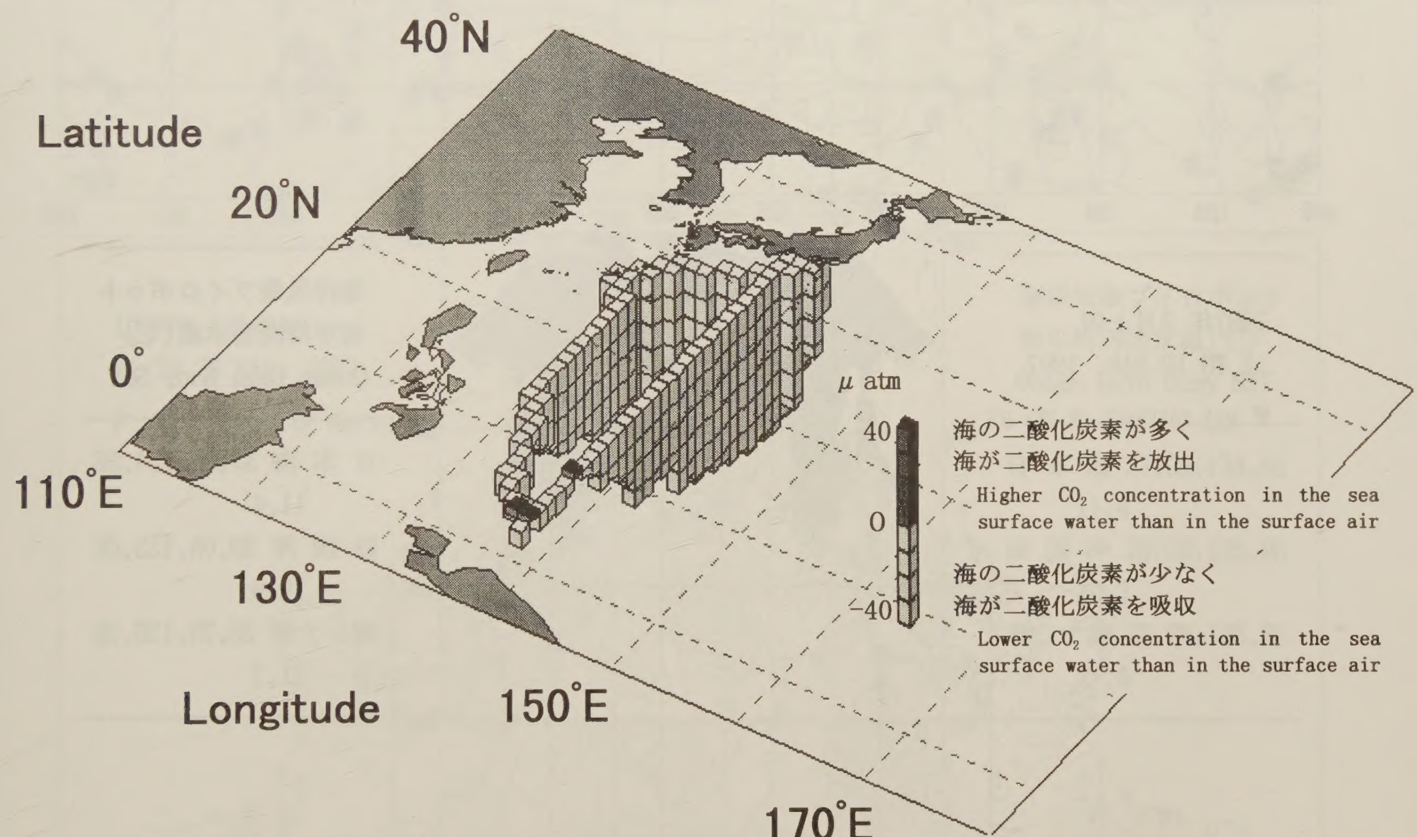
In the middle latitude of the Pacific, negative SST anomalies less than -0.5°C were observed between 30°N and 40°N from 175°E to 155°W. SSTs were more than 0.5°C above normal north of 45°N except off Alaska Bay. Positive SST anomalies more than 1°C were observed from 30°N to 40°N east of 150°W (Fig. 16).

北西太平洋における二酸化炭素の観測

Observation of carbon dioxide in the western North Pacific

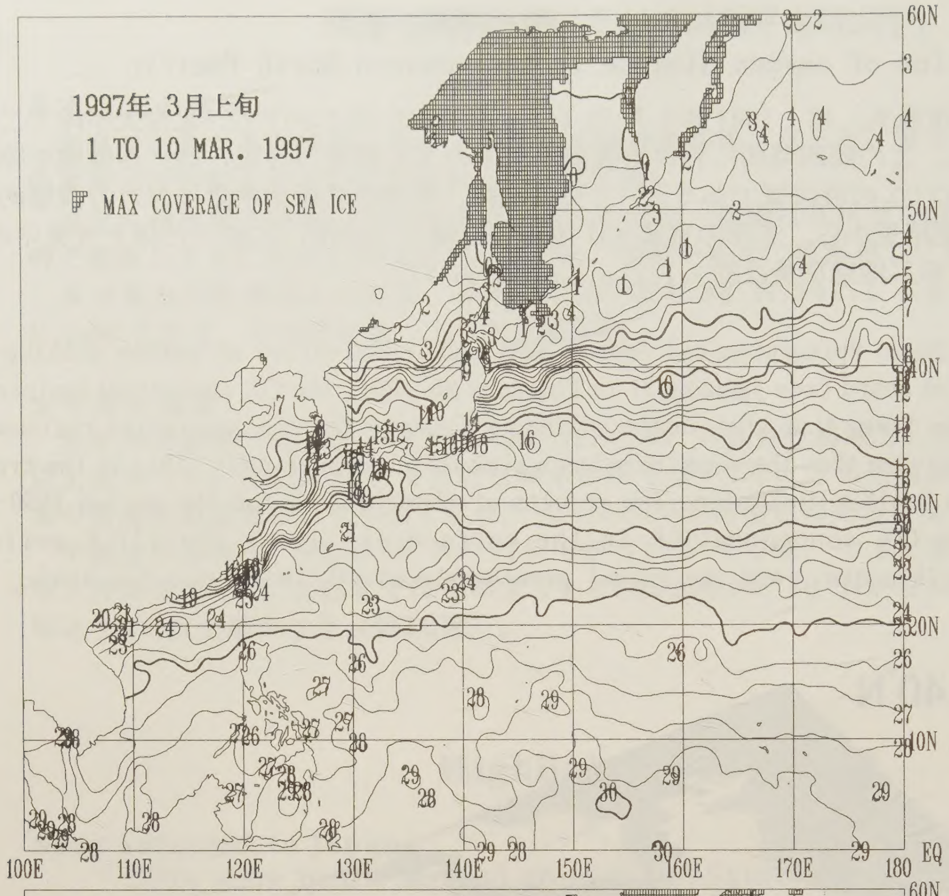
気象庁の海洋気象観測船「凌風丸」は、1997 年 1 月 21 日から 2 月 25 日にかけて、北西太平洋で二酸化炭素（CO_2）の観測を実施した。この観測期間における表面海水中の CO_2 濃度（分圧）は、赤道域を除いて大気中より低く、海洋は大気の CO_2 の吸収域であった。この傾向は、冬季の北西太平洋における典型的な傾向である。1990-1997 年の観測結果から、冬季の東経 137 度線（北緯 3～22 度）に沿った洋上大気中の CO_2 の濃度増加量は約 10 μ atm、年平均増加量は約 1.5 μ atm／年であった。

The R/V *Ryofu Maru* of the Japan Meteorological Agency(JMA) made observation of carbon dioxide(CO_2) in the western North Pacific on board from January 21 to February 25, 1997. The CO_2 concentration(partial pressure) in surface water was lower than that in the surface air except for the equatorial regions for the period of observation, implying that the ocean acted as a sink for atmospheric CO_2. This is the typical feature of the western North Pacific in winter. The results of observations for the period 1990-1997 indicated the increase in CO_2 concentration in the surface air along the 137°E meridian (3-22°N) in winter is about 10 μ atm , and the annual growth rate of CO_2 is about 1.5 μ atm/yr.



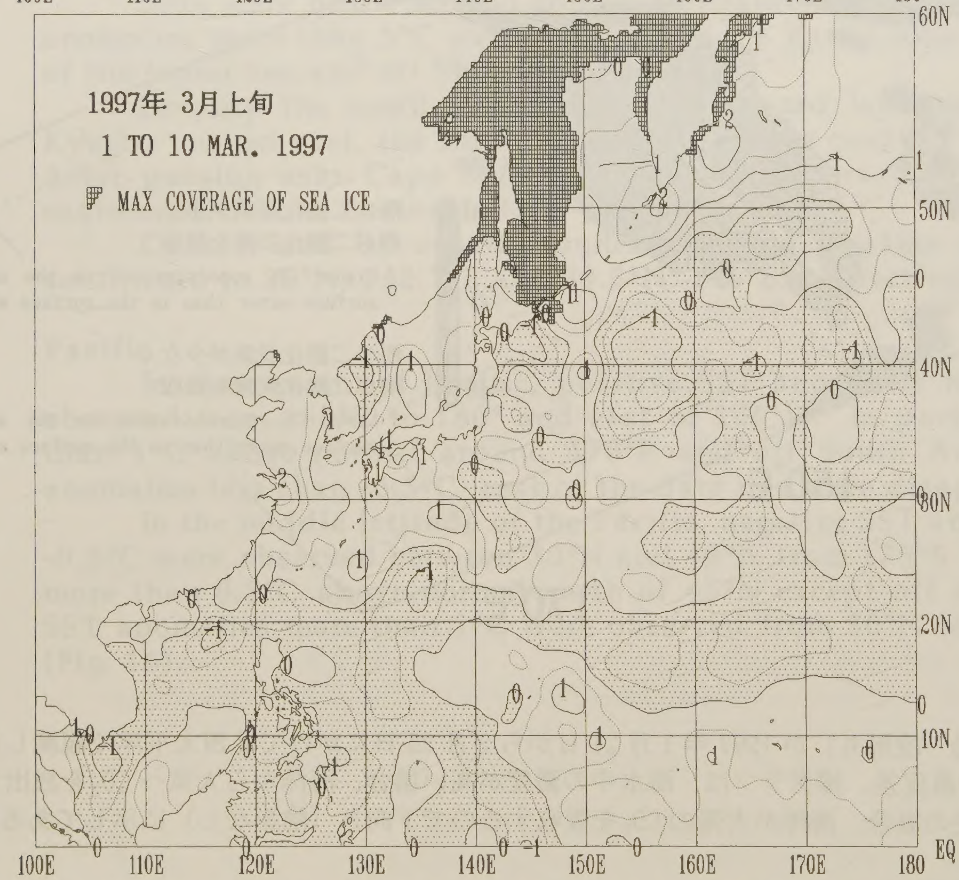
図A　気象庁の海洋気象観測船「凌風丸」が 1997 年 1 月 21 日から 2 月 25 日にかけて北西太平洋で観測した洋上大気中と表面海水中の CO_2 の濃度差。棒グラフは、海水中の濃度が高い場合、海洋から大気へ CO_2 を放出するので上向き（陰影あり）に、逆の場合、海洋が大気の CO_2 を吸収するので下向き（陰影なし）に示してある。

Fig. A　Differences between CO_2 concentration in the surface water and that in the surface air in the western North Pacific observed by the R/V *Ryofu Maru* of JMA from January 21 to February 25, 1997. Shaded upward pillars indicate that the ocean was emitting CO_2 to the surface air due to higher CO_2 concentration in the surface water. Downward pillars indicate absorption of atmospheric CO_2 into the ocean.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	22.2	1.0
御前崎(47655)	12.0	0.9
八丈島(47678)	17.7	1.2
小名浜(47598)	11.1	2.3
宮　古(47585)	7.4	1.5
江　差(47428)	4.9	-
浜　田(47755)	13.0	-

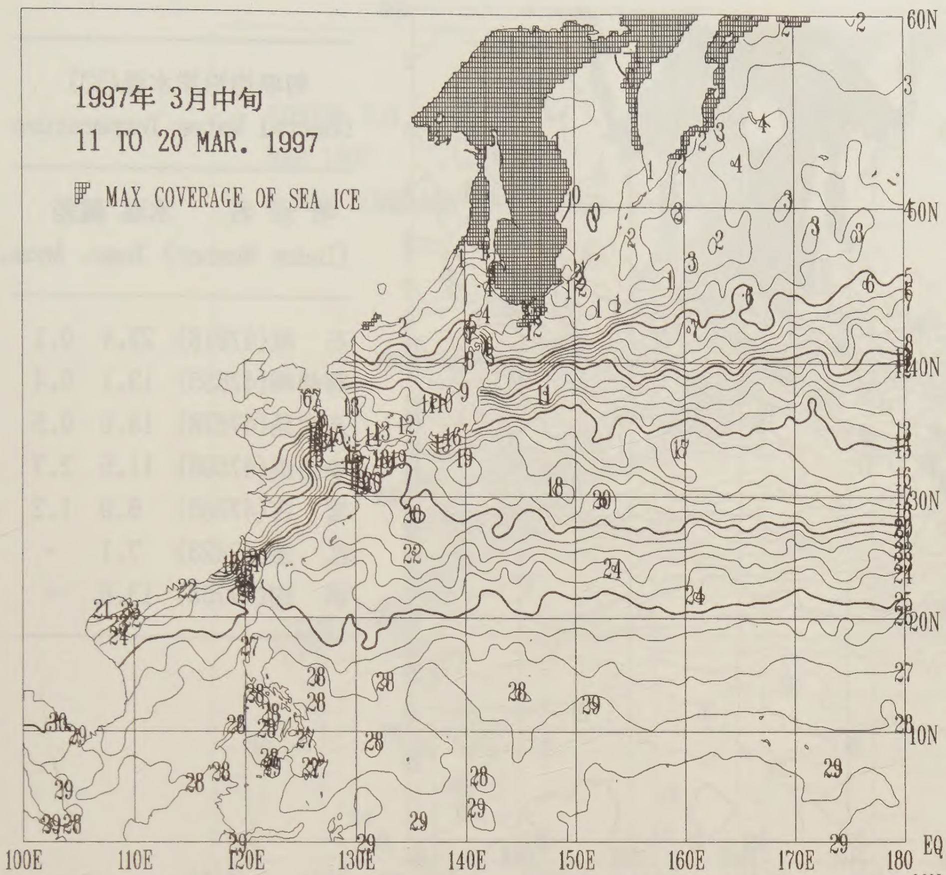


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

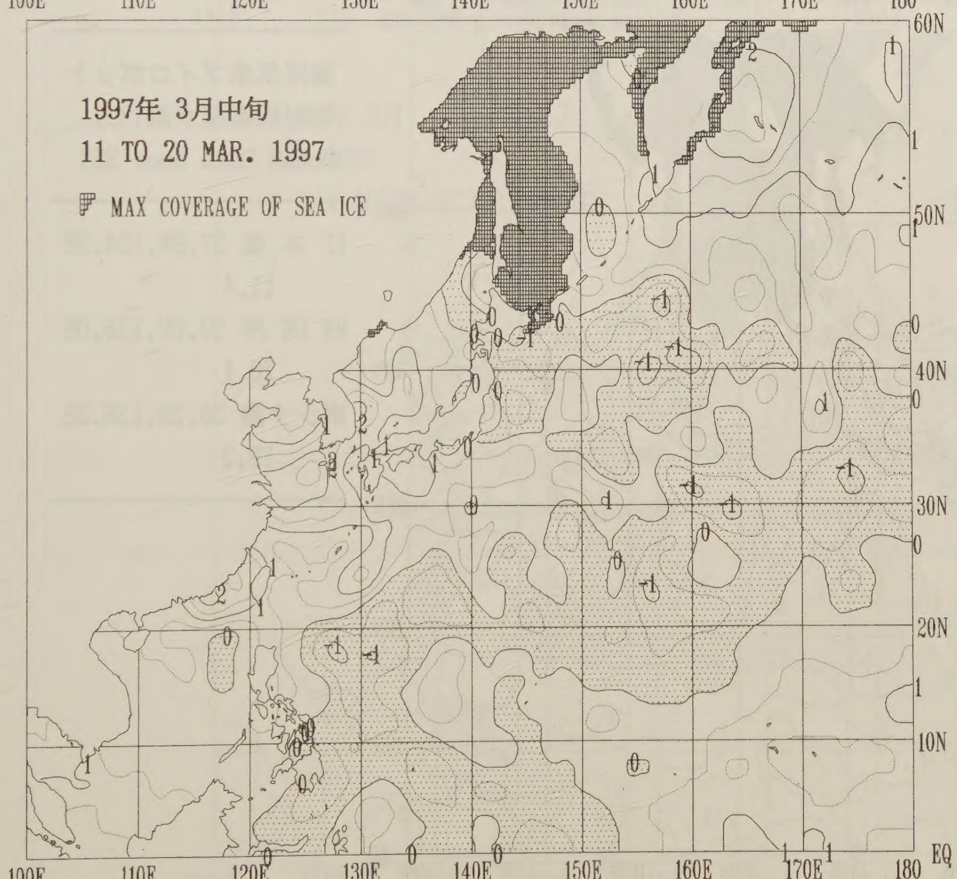
日本海 37.9N,134.5E	11.4
四国沖 29.0N,135.0E	19.9
東シナ海 28.2N,126.3E	21.2

第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年 3月上旬)

Fig.1 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 1st ten-day period in MAR 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown as broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃) Coastal Water Temperature		
地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	23.0	1.1
御前崎(47655)	12.6	0.8
八丈島(47678)	18.6	1.4
小名浜(47598)	11.4	2.5
宮　古(47585)	7.0	1.4
江　差(47428)	6.3	-
浜　田(47755)	13.6	-

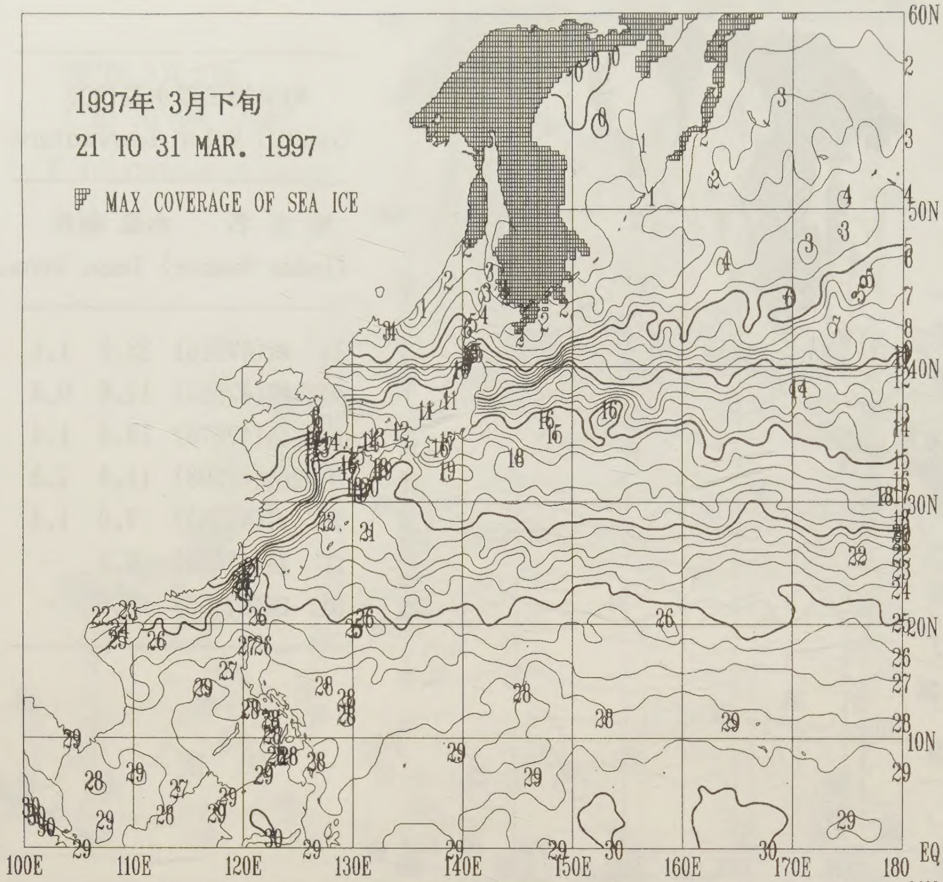


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日 本 海	37.9N,134.5E 11.4
四 国 沖	29.0N,135.0E 20.3
東シナ海	28.2N,126.3E 21.5

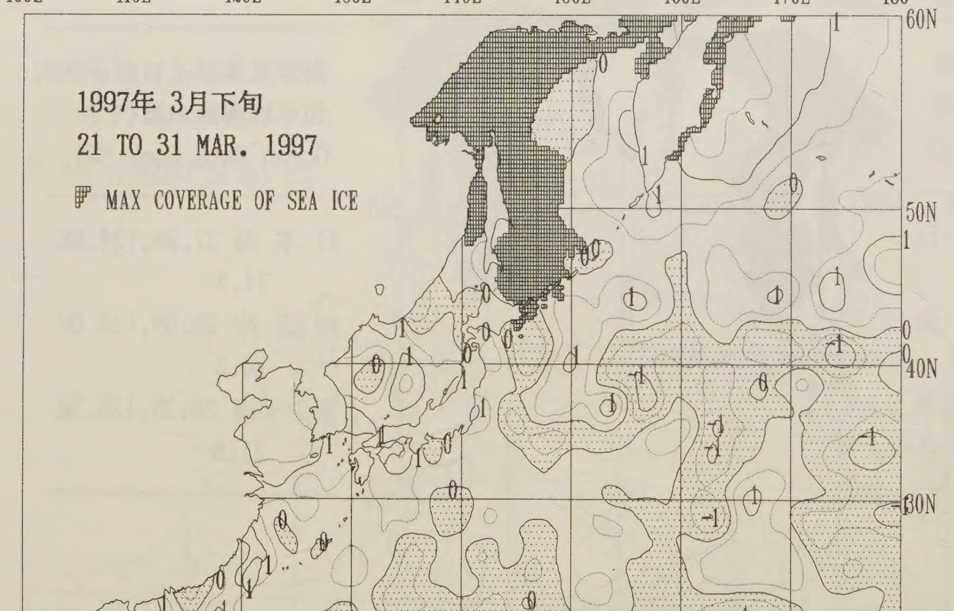
第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年 3月中旬)

Fig.2 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 2nd ten-day period in MAR 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown as broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	22.4	0.1
御前崎(47655)	13.1	0.4
八丈島(47678)	18.0	0.5
小名浜(47598)	11.6	2.7
宮　古(47585)	6.9	1.2
江　差(47428)	7.1	-
浜　田(47755)	13.6	-

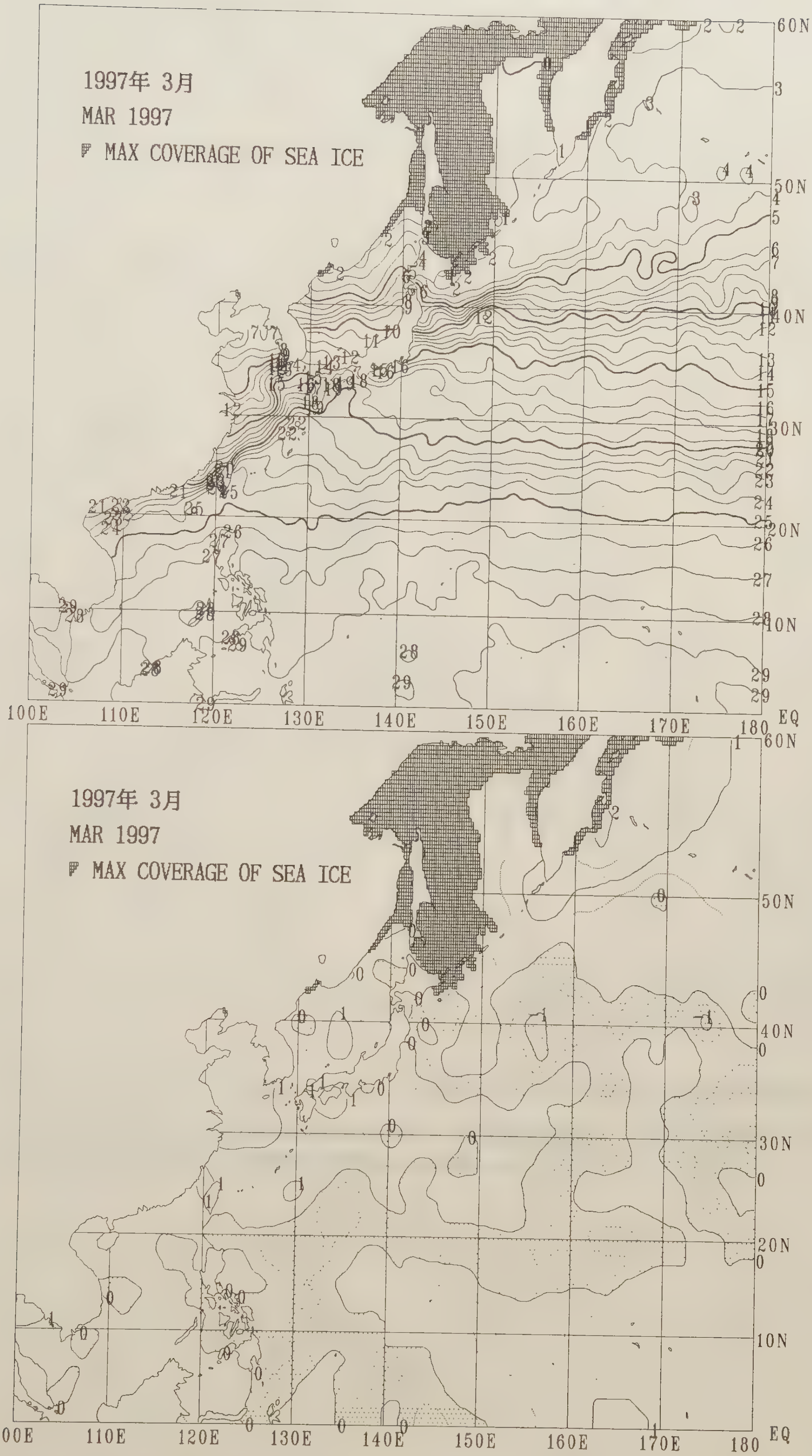


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	11.4
四国沖	29.0N,135.0E	20.1
東シナ海	28.2N,126.3E	19.2

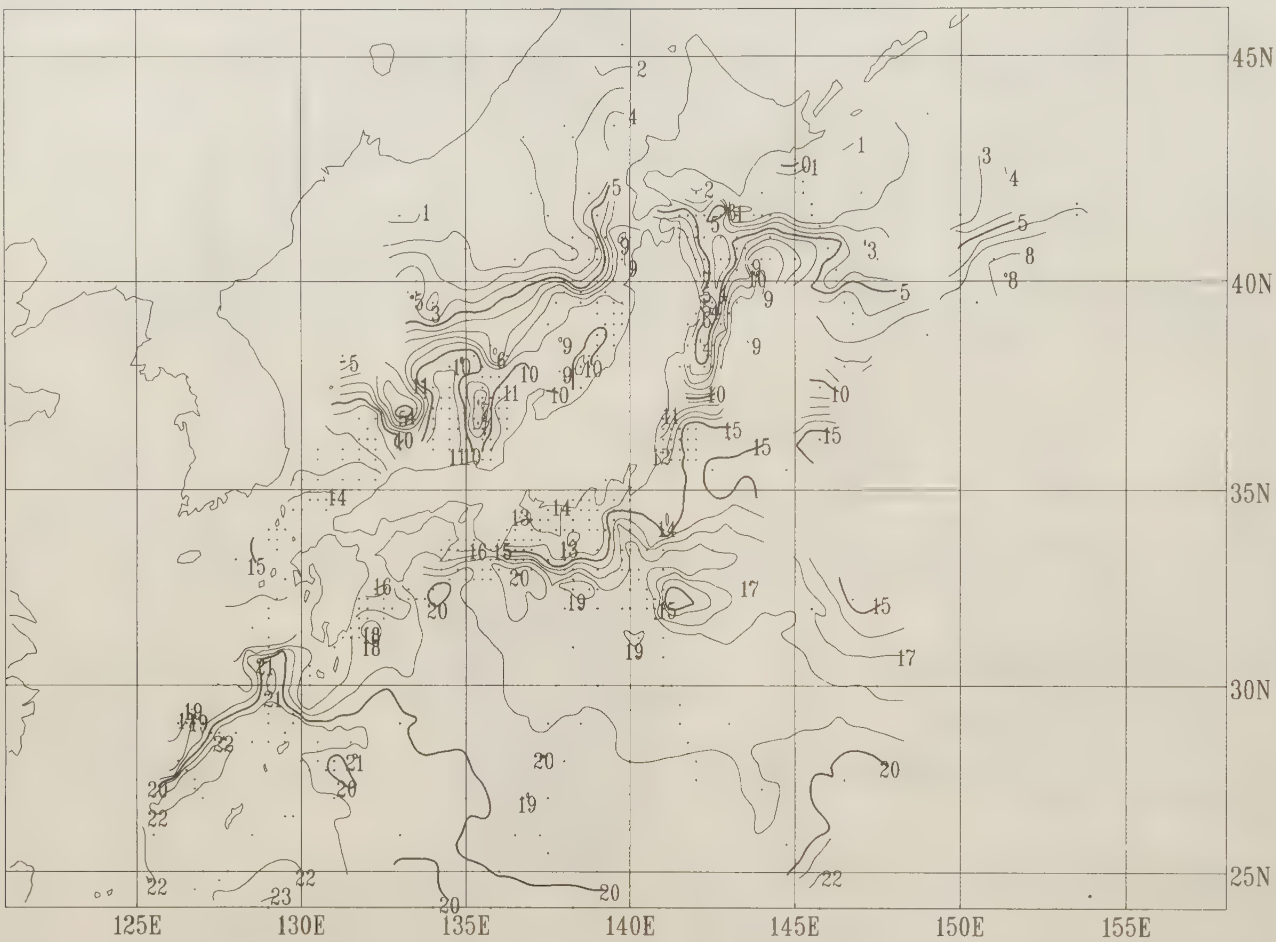
第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年 3月下旬)

Fig.3 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 3rd ten-day period in MAR 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown as broken lines. Negative anomalies are spotted.



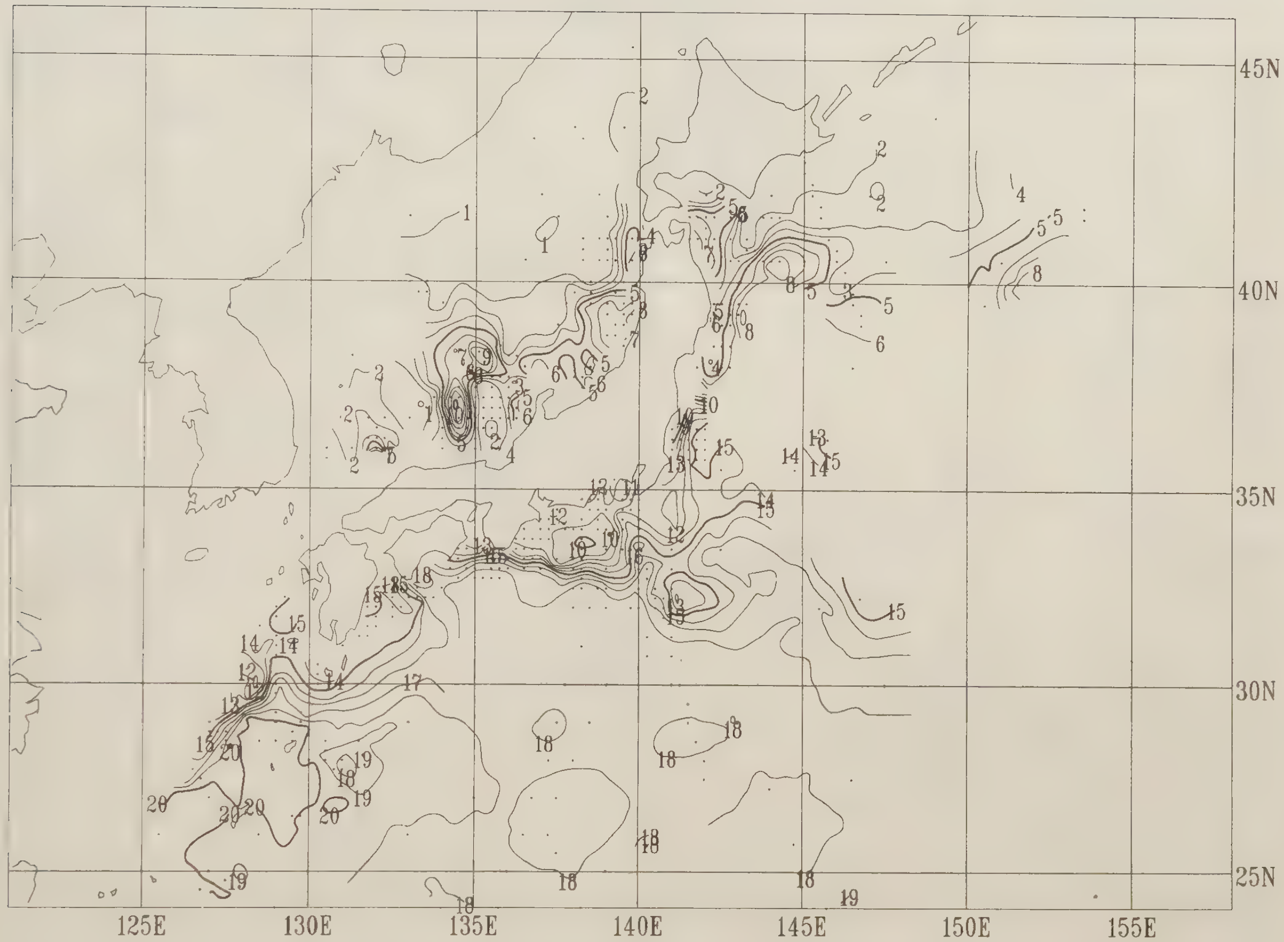
第4図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1997年 3月)

Fig.4 Monthly mean SSTs in the western North Pacific (top) and anomalies (bottom) for MAR 1997. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown as broken lines. Negative anomalies are spotted.



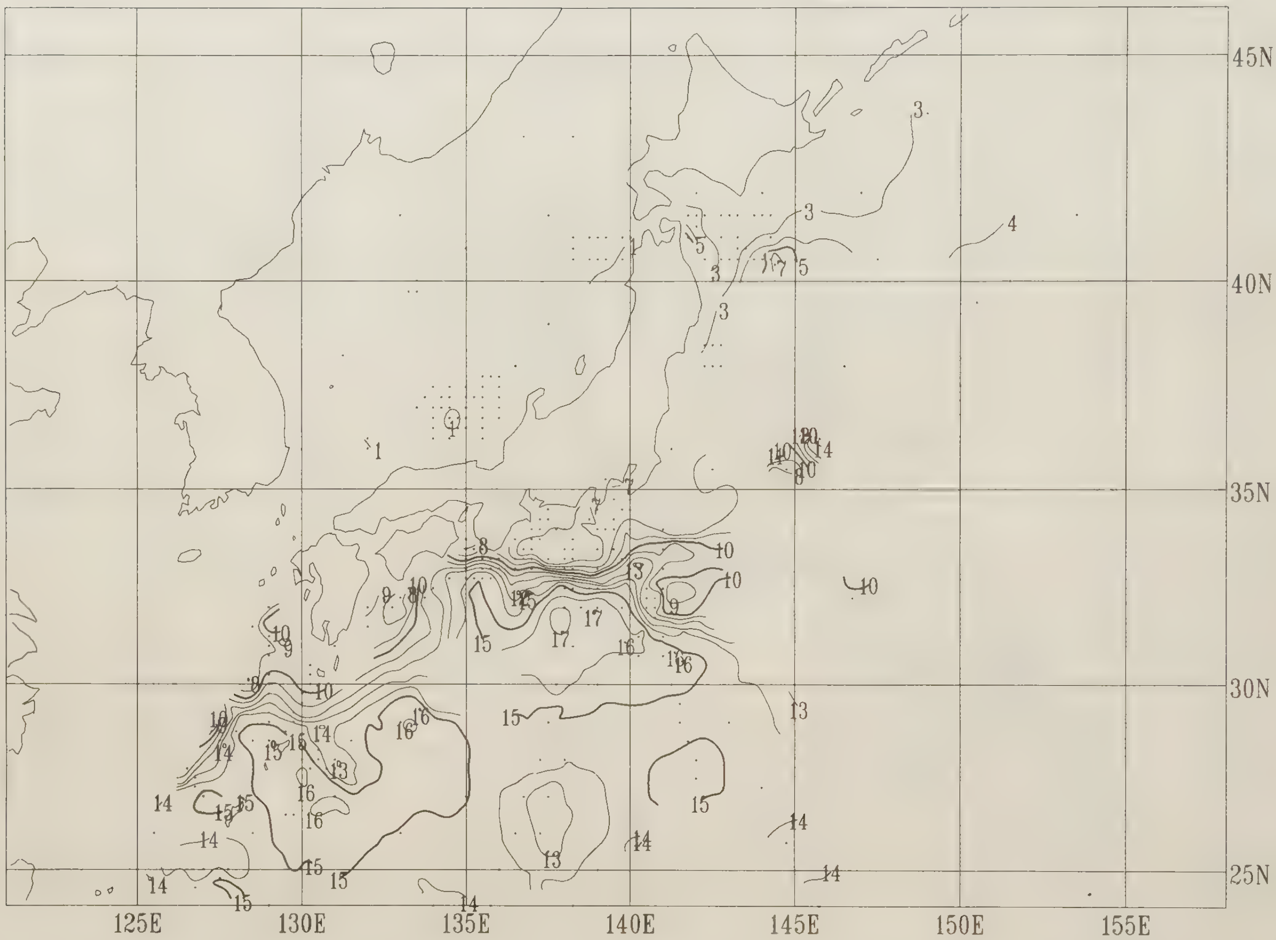
第5図　日本近海表層水温(深さ100m)図 (1997年 3月)

Fig.5 Subsurface (100m) temperatures in the seas adjacent to Japan for MAR 1997. Contour interval is 1°C. Observation points are denoted by dots.



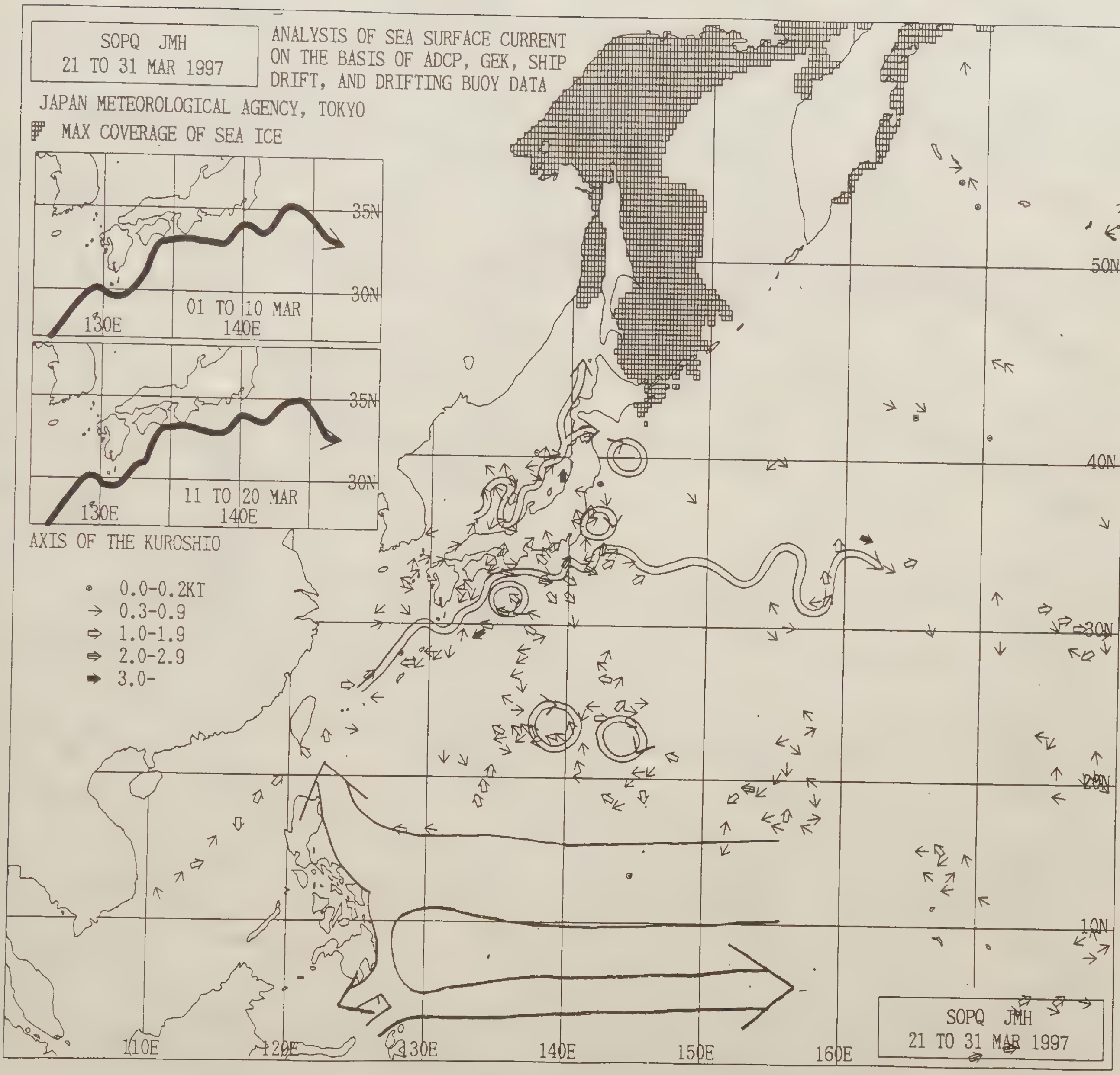
第6図　日本近海表層水温(深さ200m)図 (1997年 3月)

Fig.6 Subsurface (200m) temperatures in the seas adjacent to Japan for MAR 1997. Contour interval is 1°C. Observation points are denoted by dots.



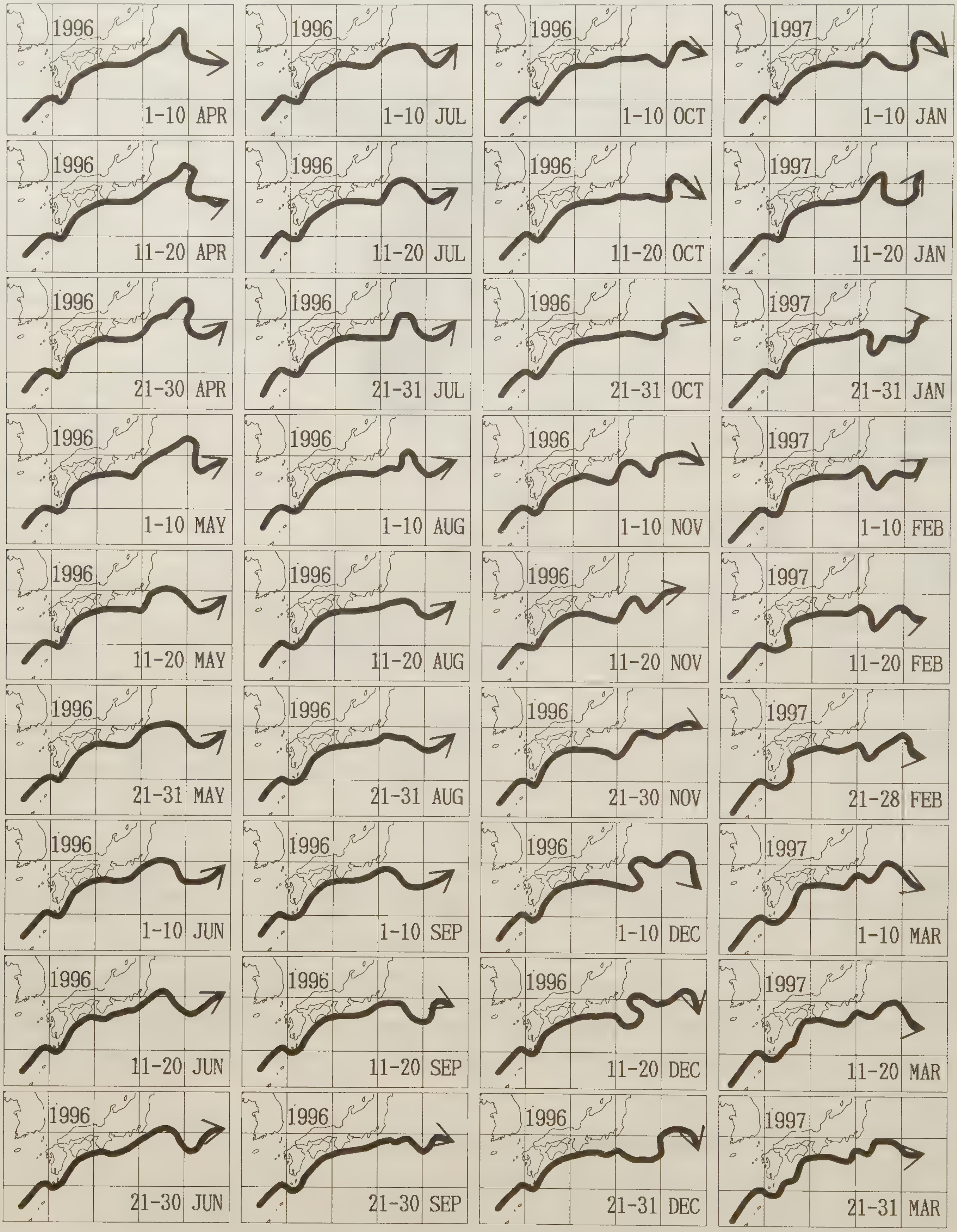
第7図　日本近海表層水温(深さ400m)図 (1997年 3月)

Fig.7 Subsurface (400m) temperatures in the seas adjacent to Japan for MAR 1997. Contour interval is 1°C. Observation points are denoted by dots.



第8図　北西太平洋海流図（1997年 3月下旬）

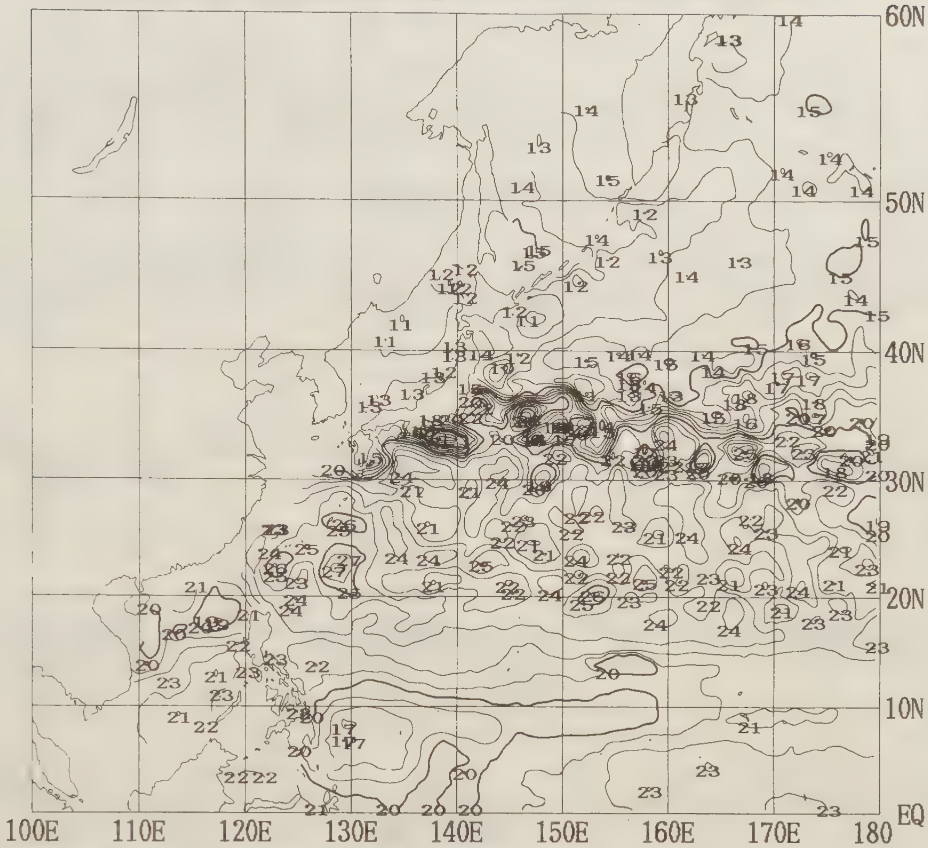
Fig.8 Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in MAR 1997. Small arrows indicate sea surface currents measured with acoustic Doppler current profilers, GEKs deployed in research vessels, and ship drift by merchant ships/drifting buoys during the month. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.



第9図 旬別黒潮流軸図

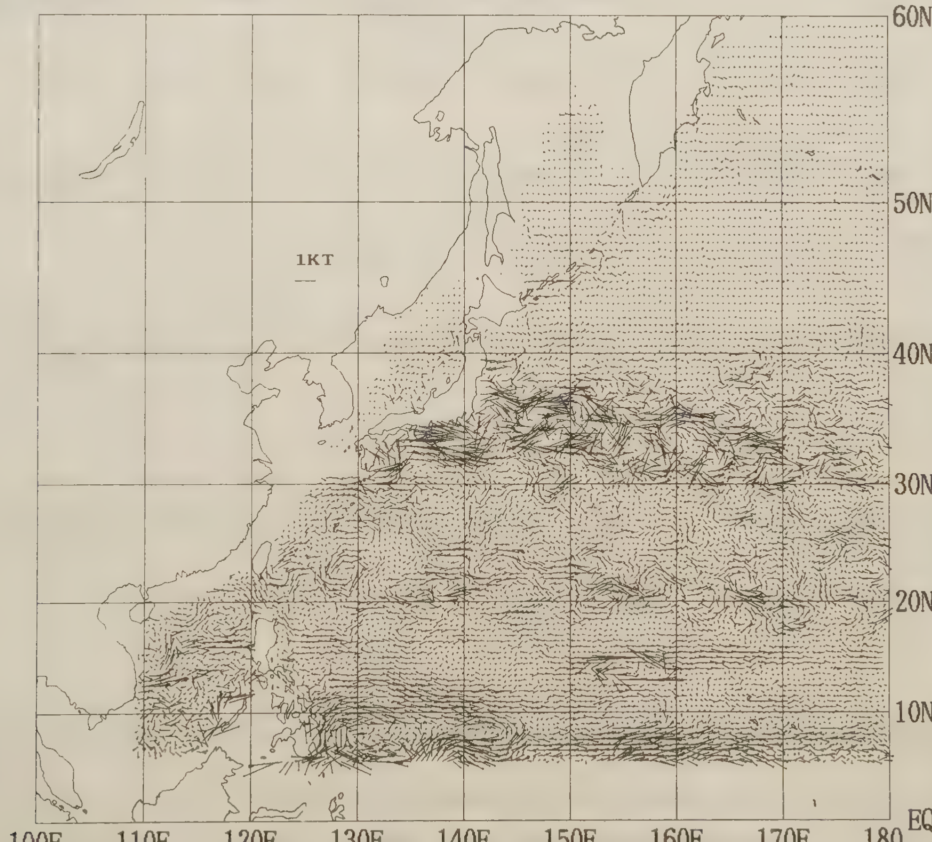
Fig.9 Time series of the Kuroshio axis

Sea surface dynamic heights and current distribution



第10図 北西太平洋海面力学高度分布図(1997年 3月22日)

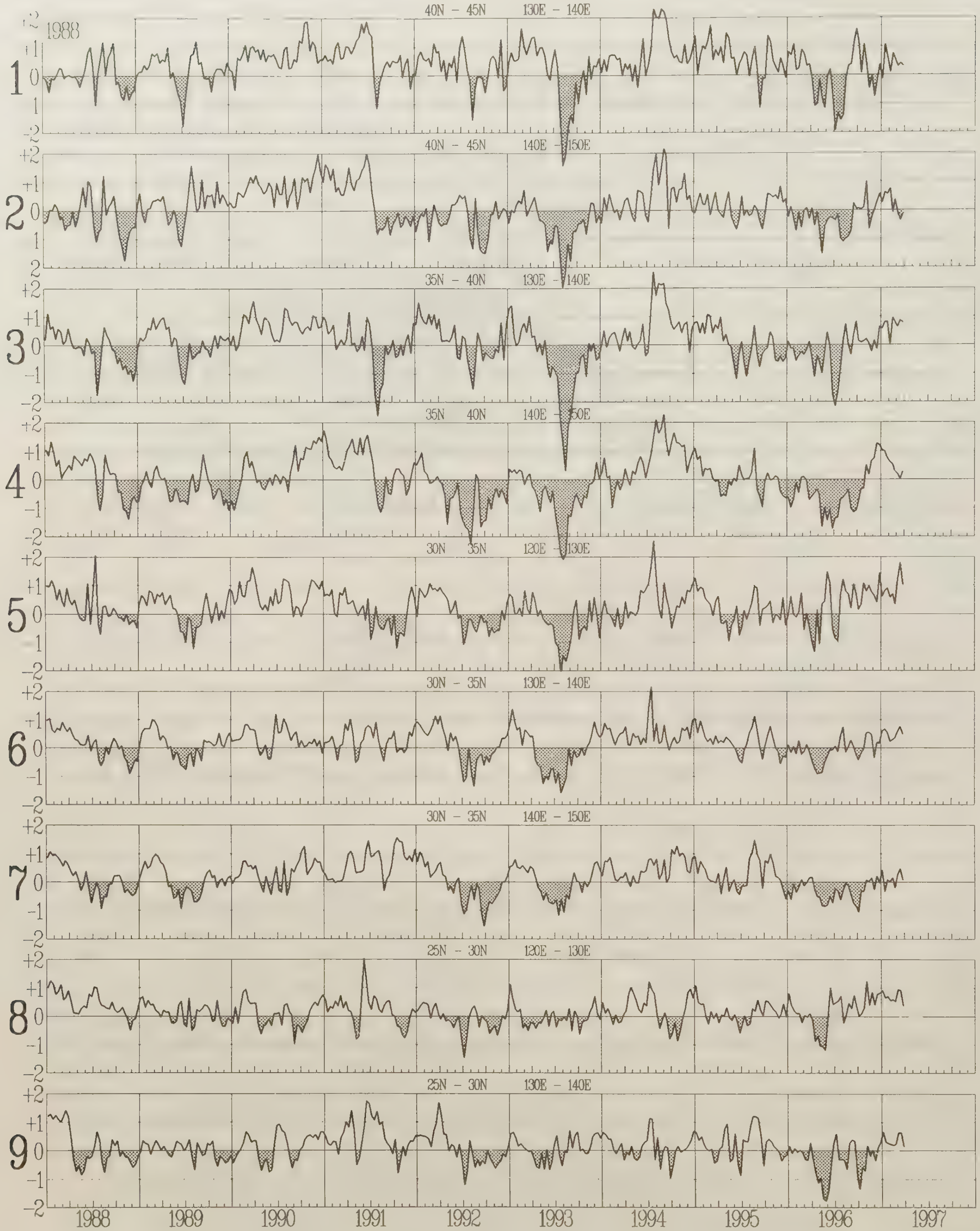
Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (MAR 22,1997).
1500db surface is assumed to be no current surface.

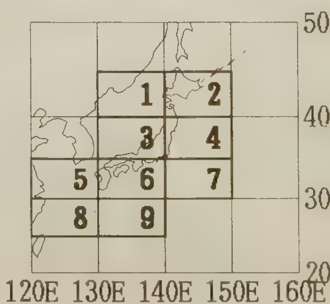


第11図 北西太平洋海流ベクトル図(1997年 3月22日)

Fig.11 Sea surface current vectors in the western North Pacific (MAR 22,1997).
Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and sub-surface temperature distribution assuming the geostrophic relation.

Time Series of Area Mean SST in the Western North Pacific

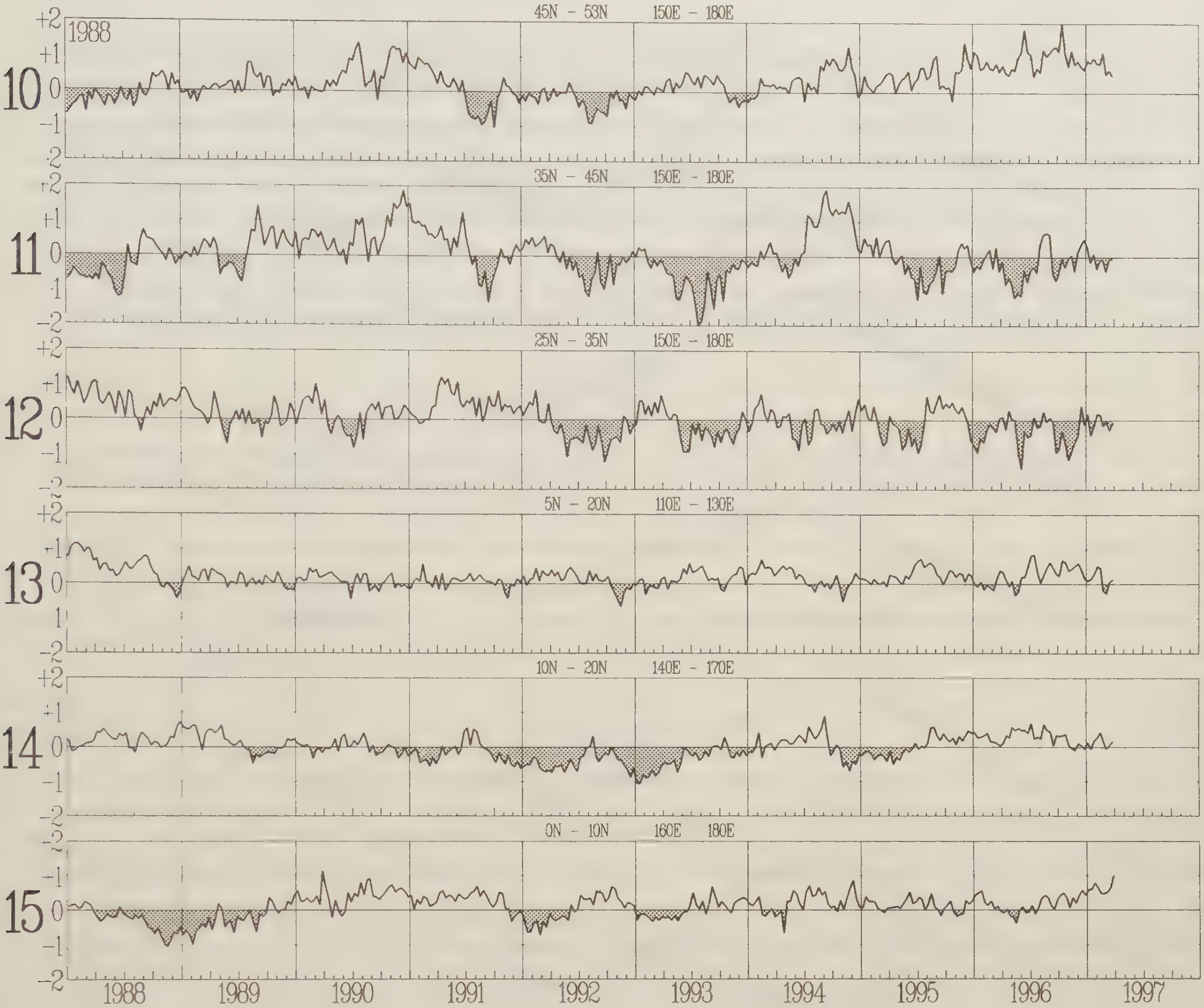




第12図　海域別旬平均海面水温平年偏差時系列図

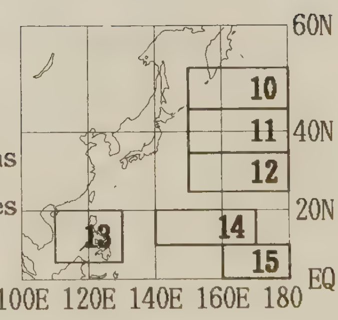
Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right figure. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

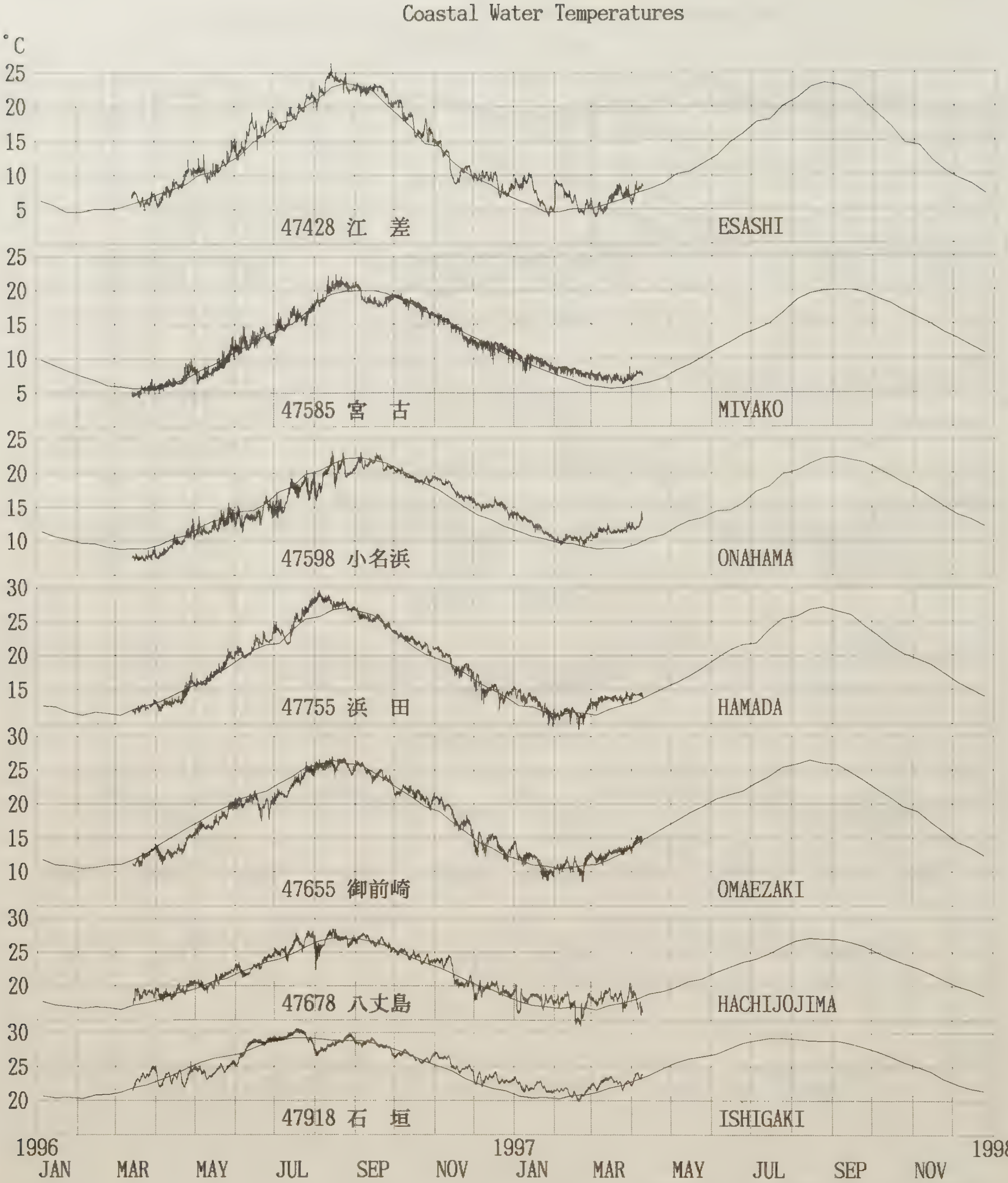
Time Series of Area Mean SST in the Western North Pacific

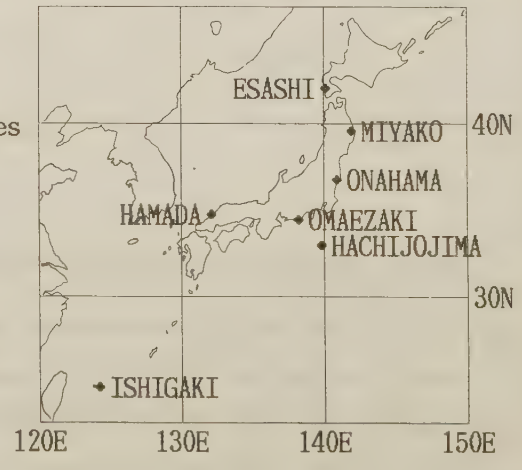


第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right figure. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

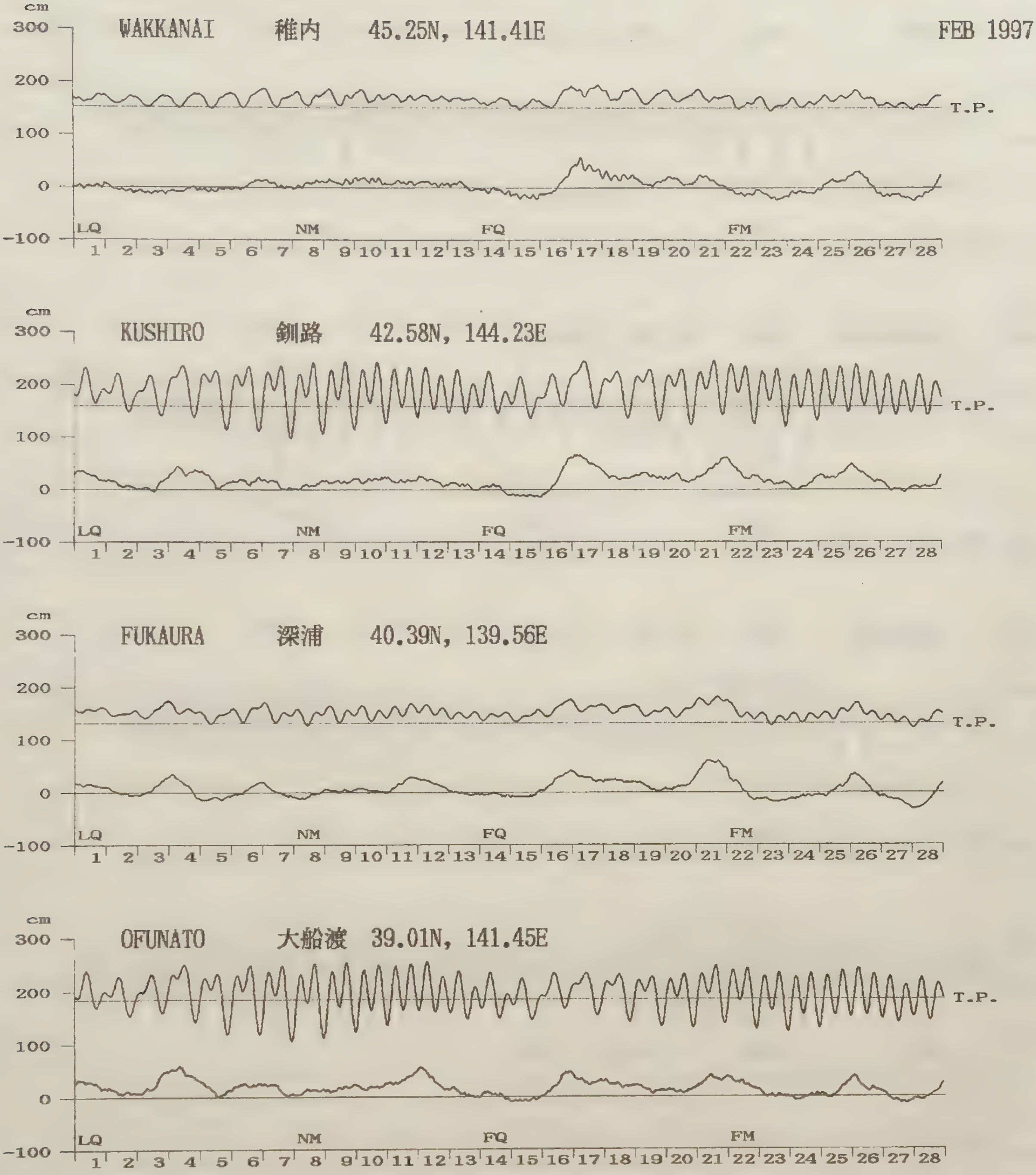


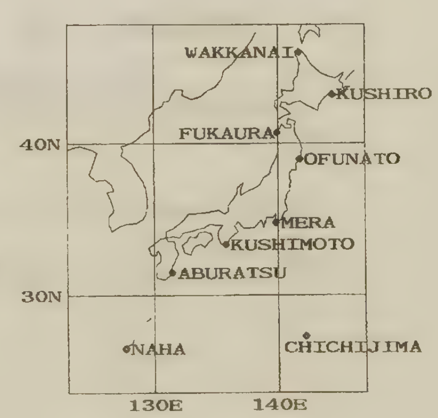




第13図 沿岸水温時系列図

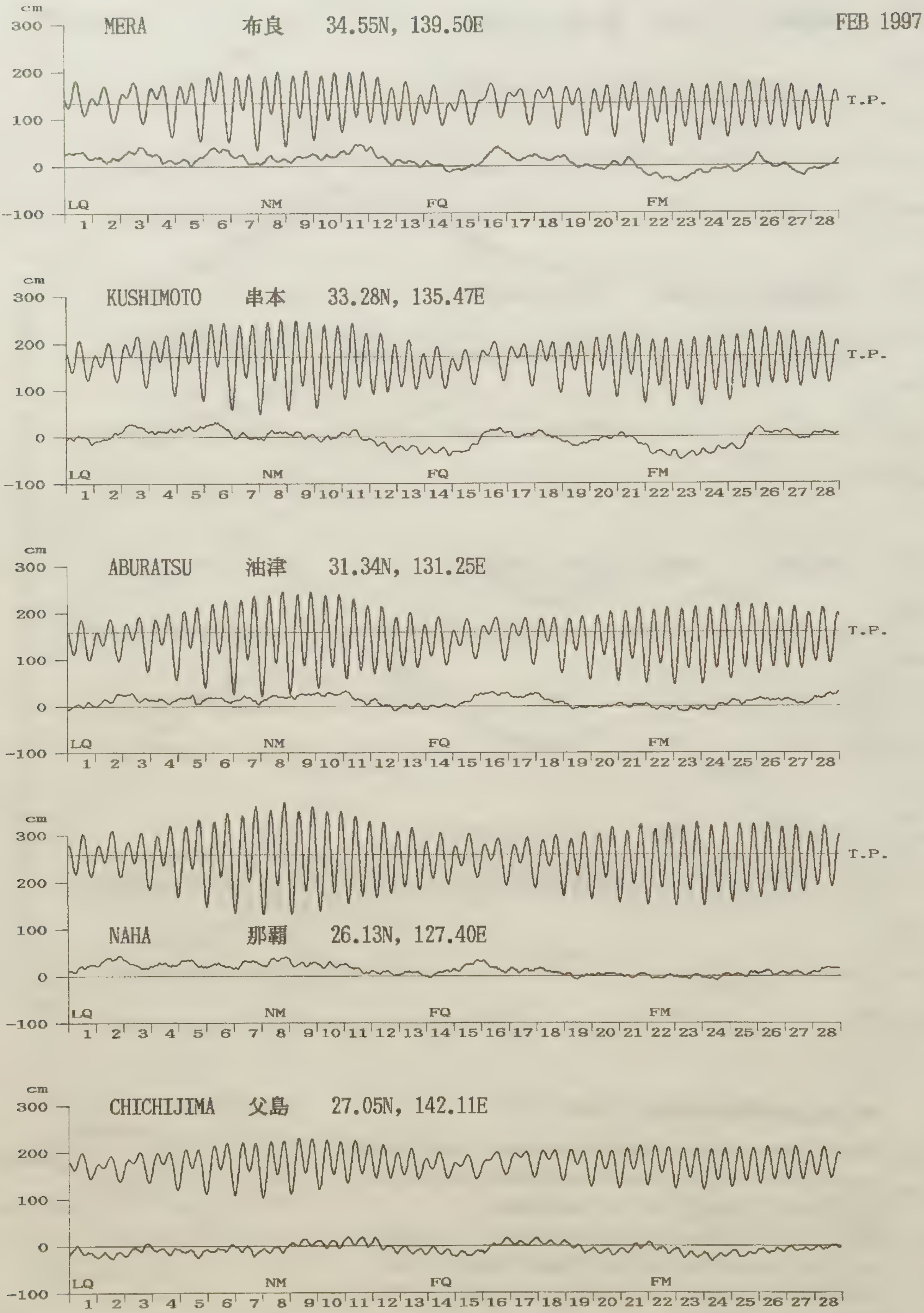
Fig.13 Time series of hourly coastal water temperatures (°C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show 10-day mean climatology.





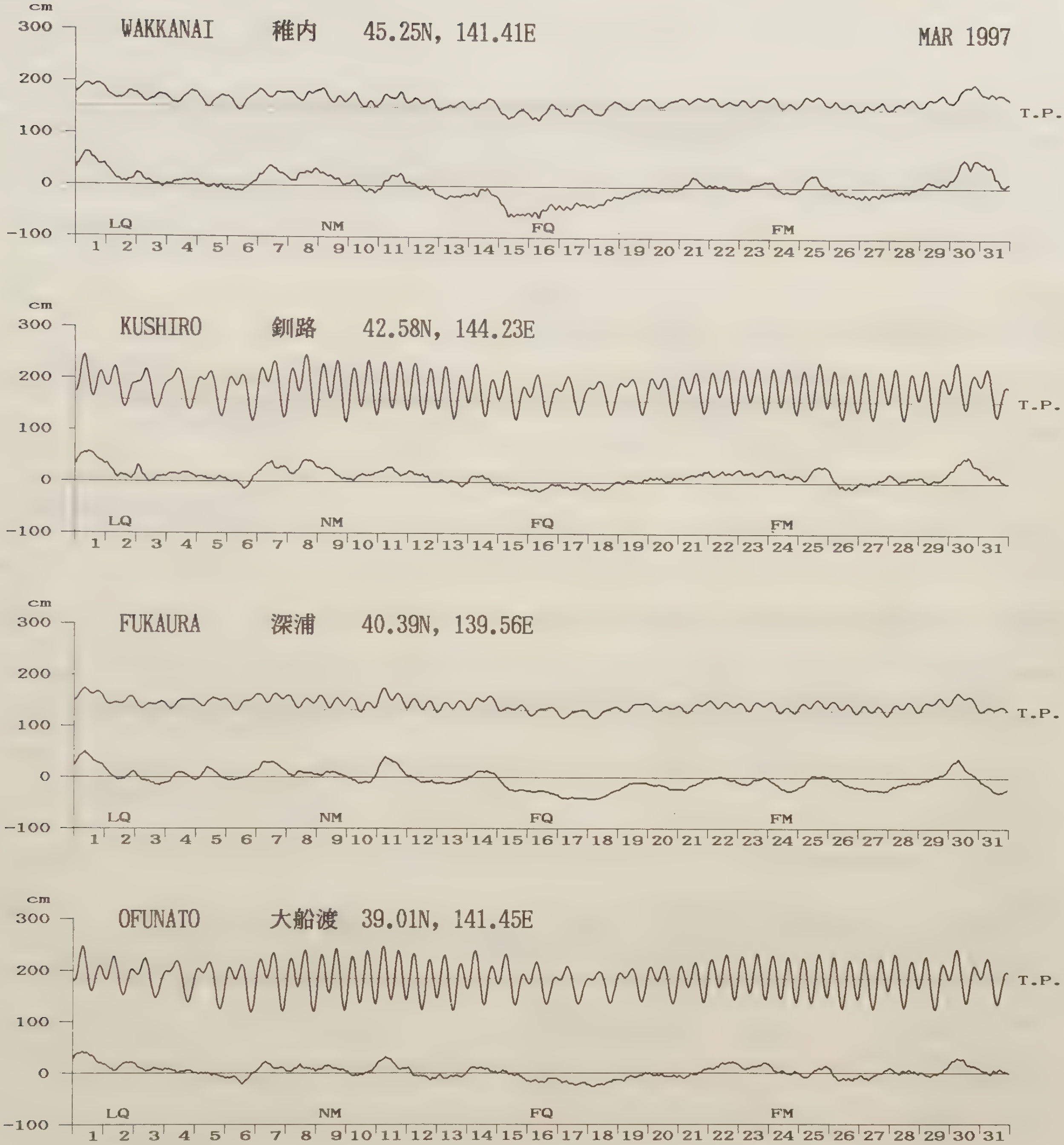
第14図 沿岸潮位時系列図 (1997年 2月)

Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.
Sea level anomalies are two times values of the differences between the observations and the predicted astronominal tide.
FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)



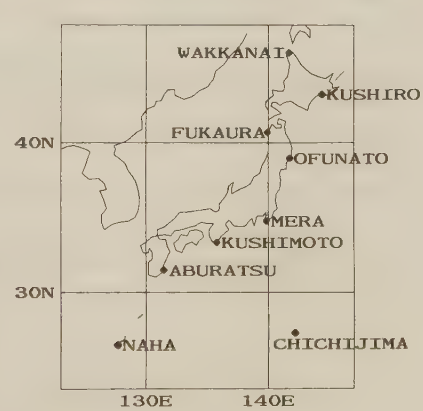
第14図 つづき
Fig.14 continue

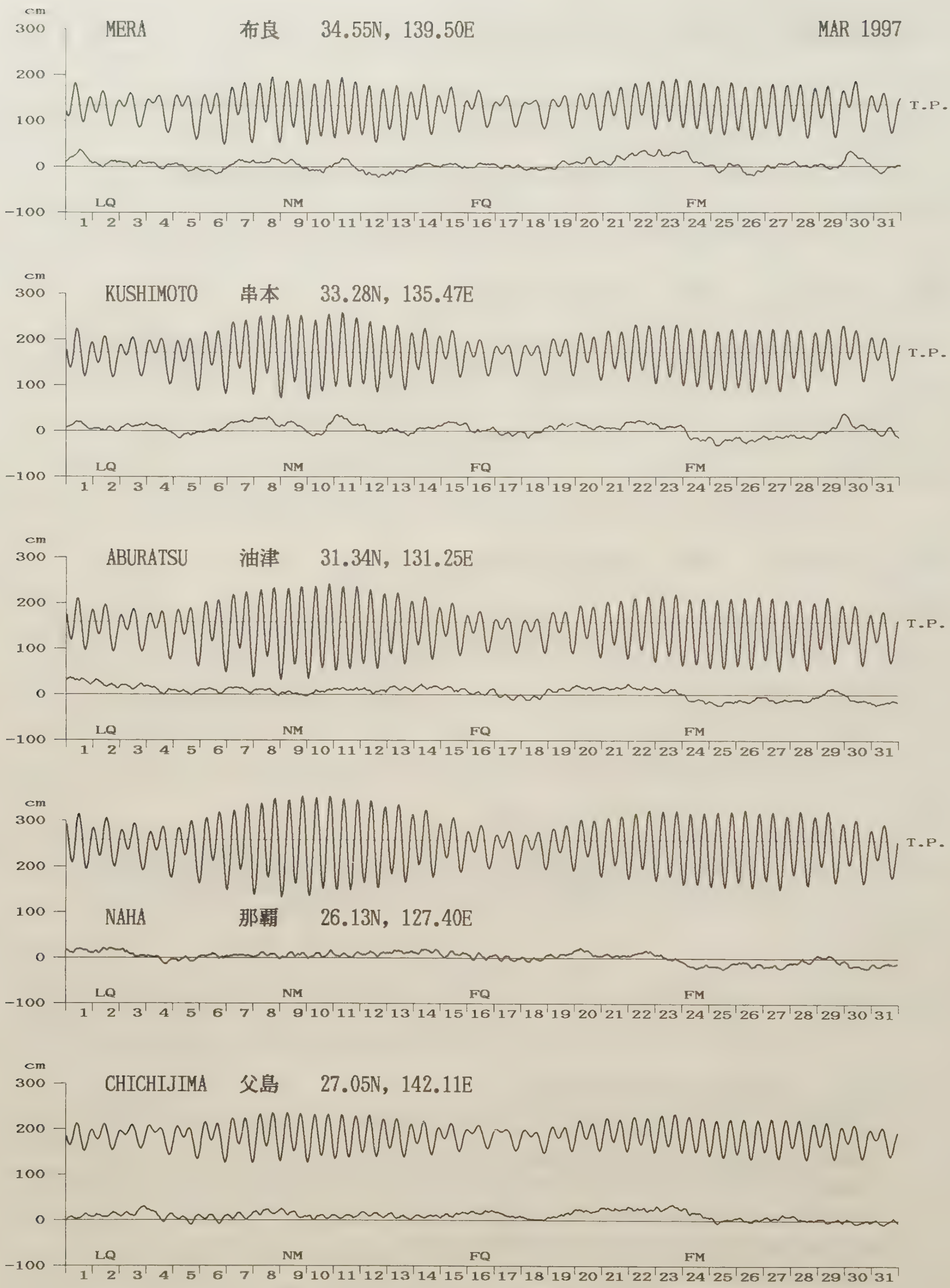
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第14図 沿岸潮位時系列図（1997年 3月）

Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.
Sea level anomalies are two times values of the differences between the observations and the predicted astronominal tide.
FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)

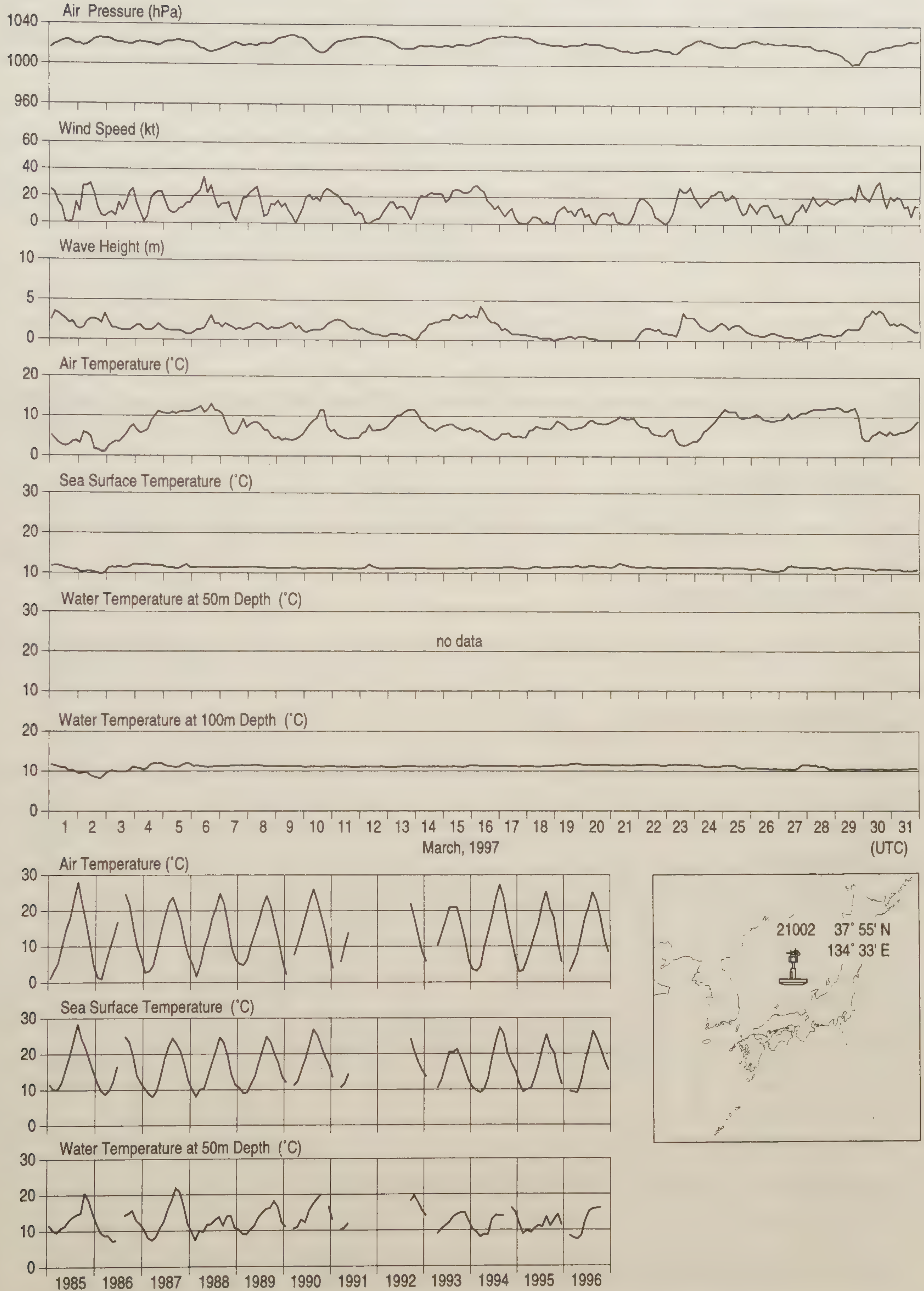




第14図 つづき

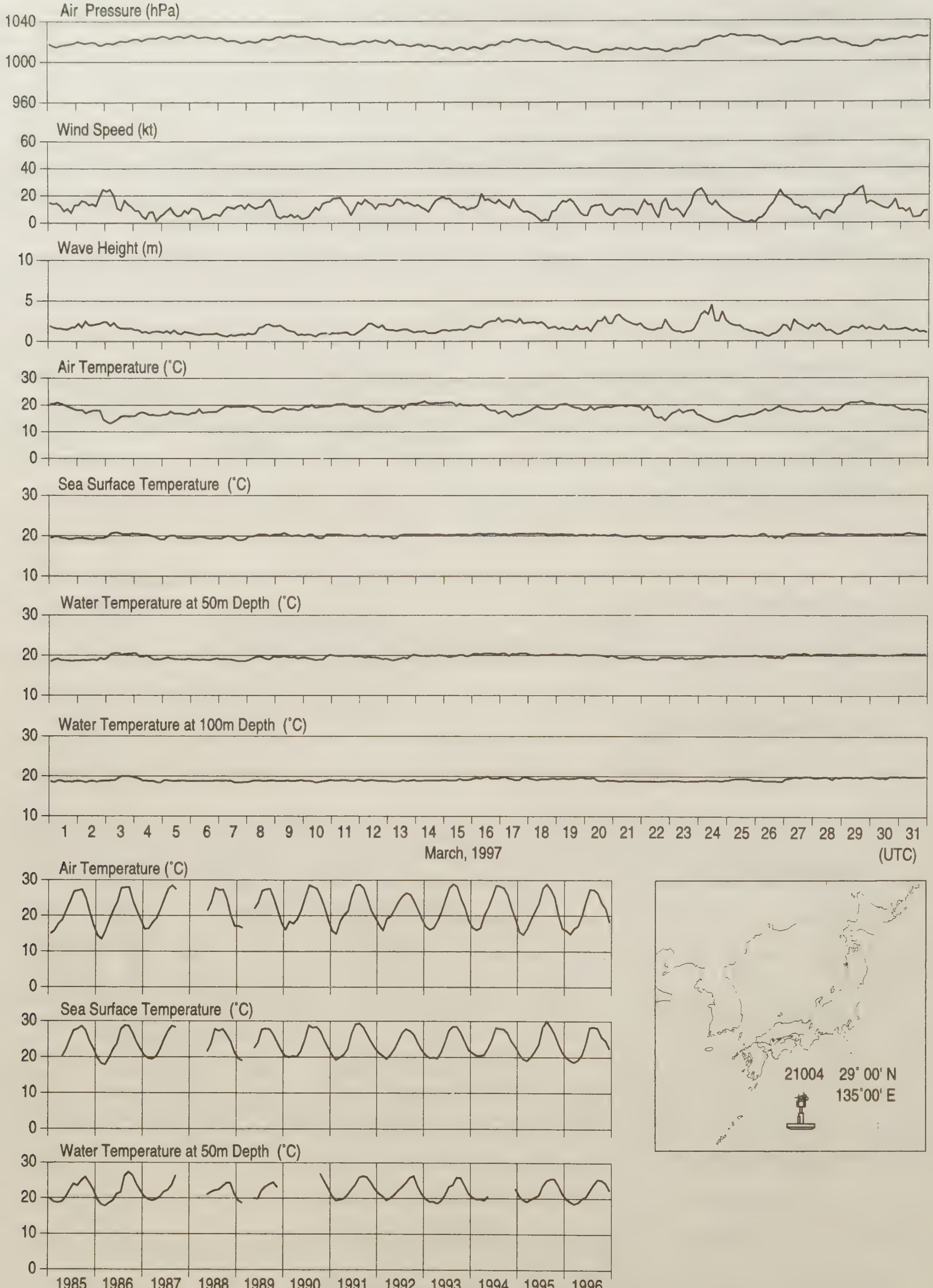
Fig.14 continue

Ocean Data Buoy Observations



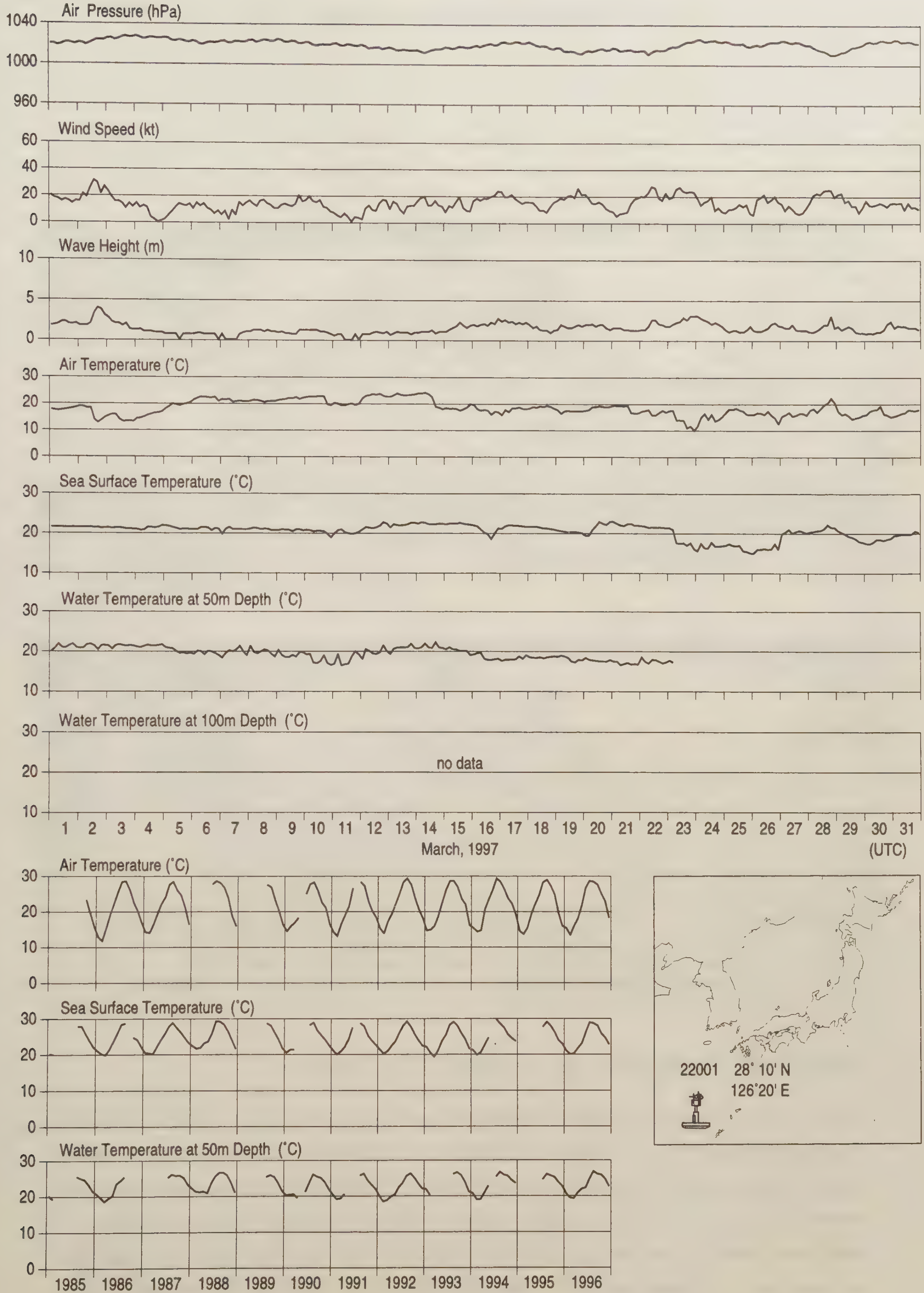
第15図　海洋気象ブイロボットによる観測の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the Japan Sea (WMO ID No.21002).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



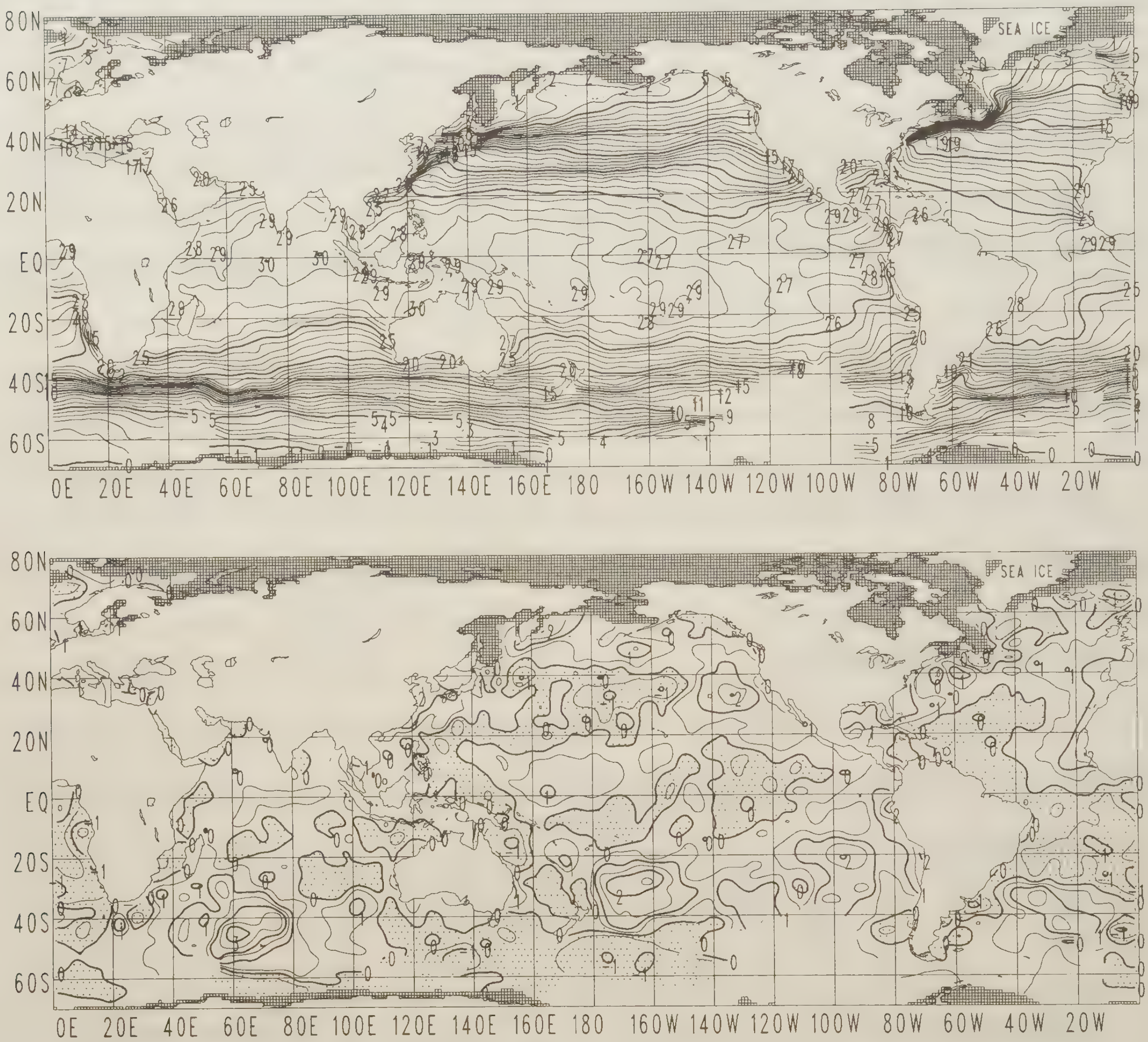
第15図　海洋気象ブイロボットによる観測の時系列図（四国沖：21004）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation south of Shikoku (WMO ID No.21004).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



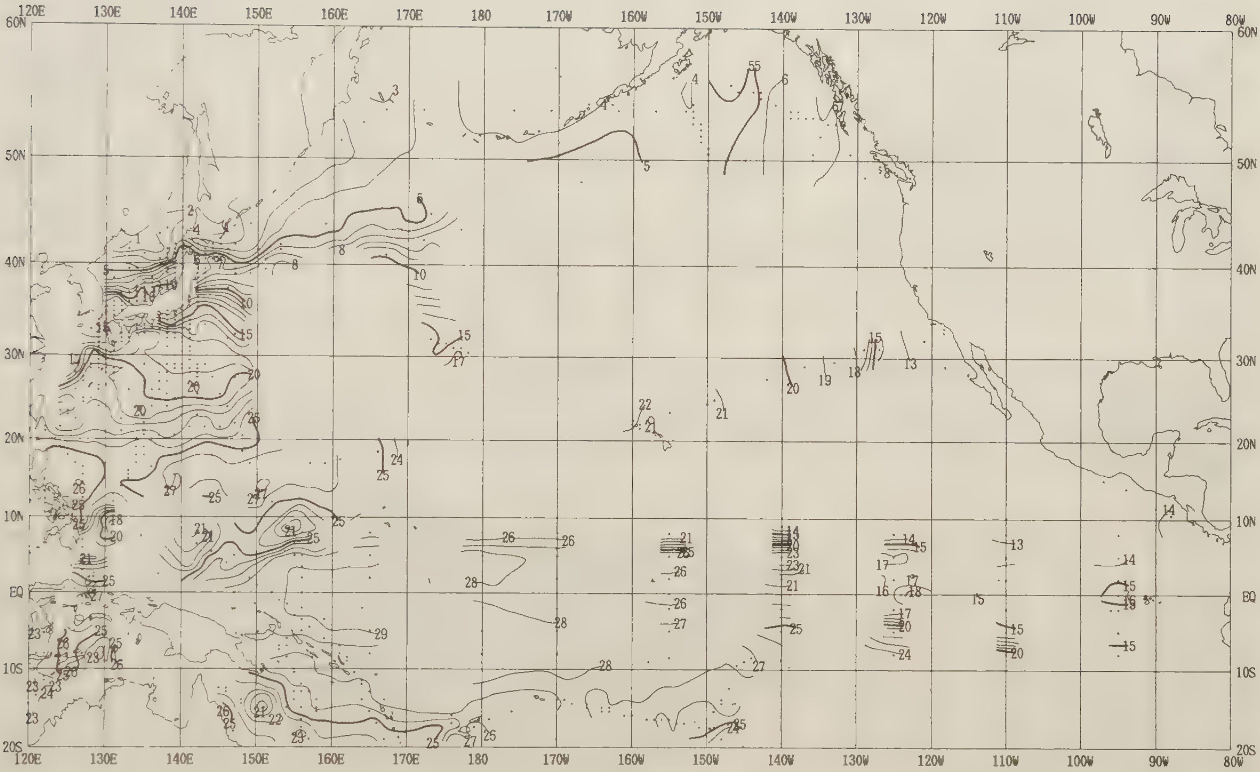
第15図　海洋気象ブイロボットによる観測の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the East China Sea (WMO ID No.22001).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



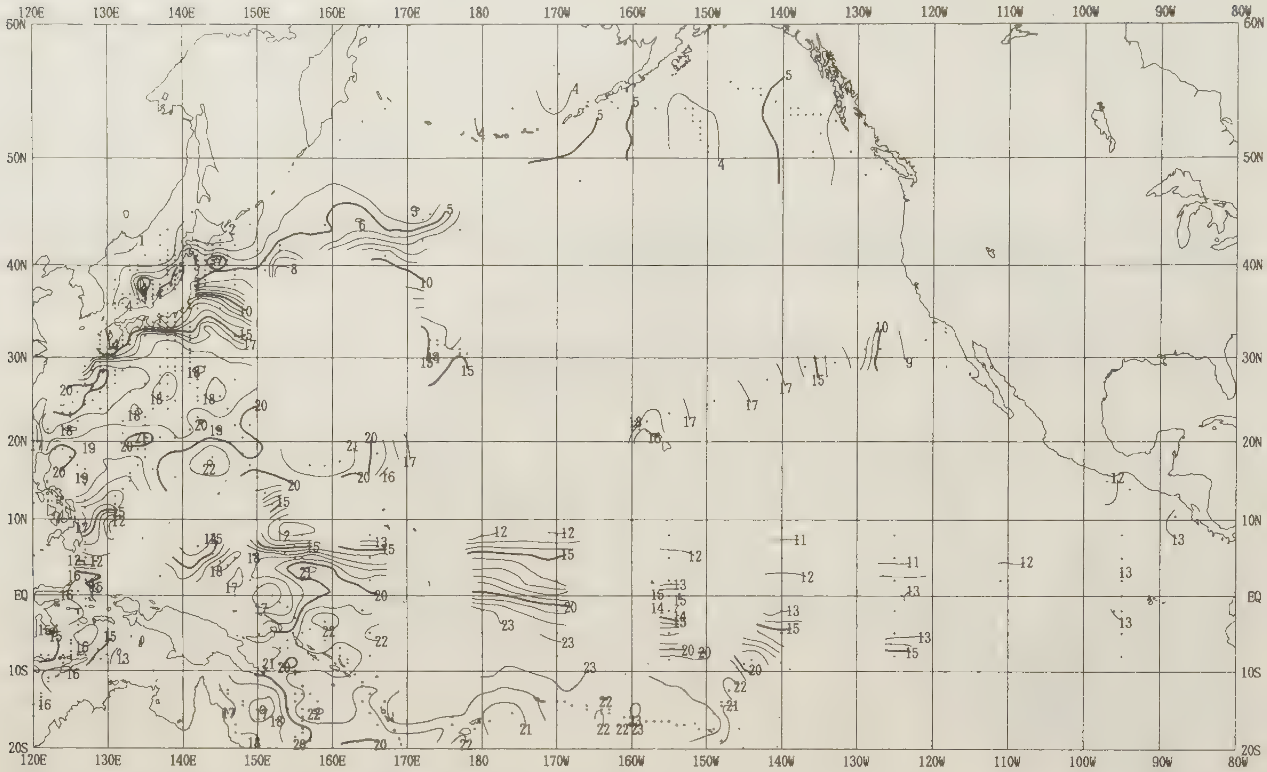
第16図　全球月平均海面水温図（上）及び偏差図（下）（1997年 3月）

Fig.16 Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for MAR 1997. Anomalies are computed from the JMA climatology (1961-1990) (Marine Department of JMA, 1991, Climatic charts of sea surface temperatures of the western North Pacific and the global ocean). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown as thin lines. Negative anomalies are spotted. Maximum coverage of sea ice is shaded. Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



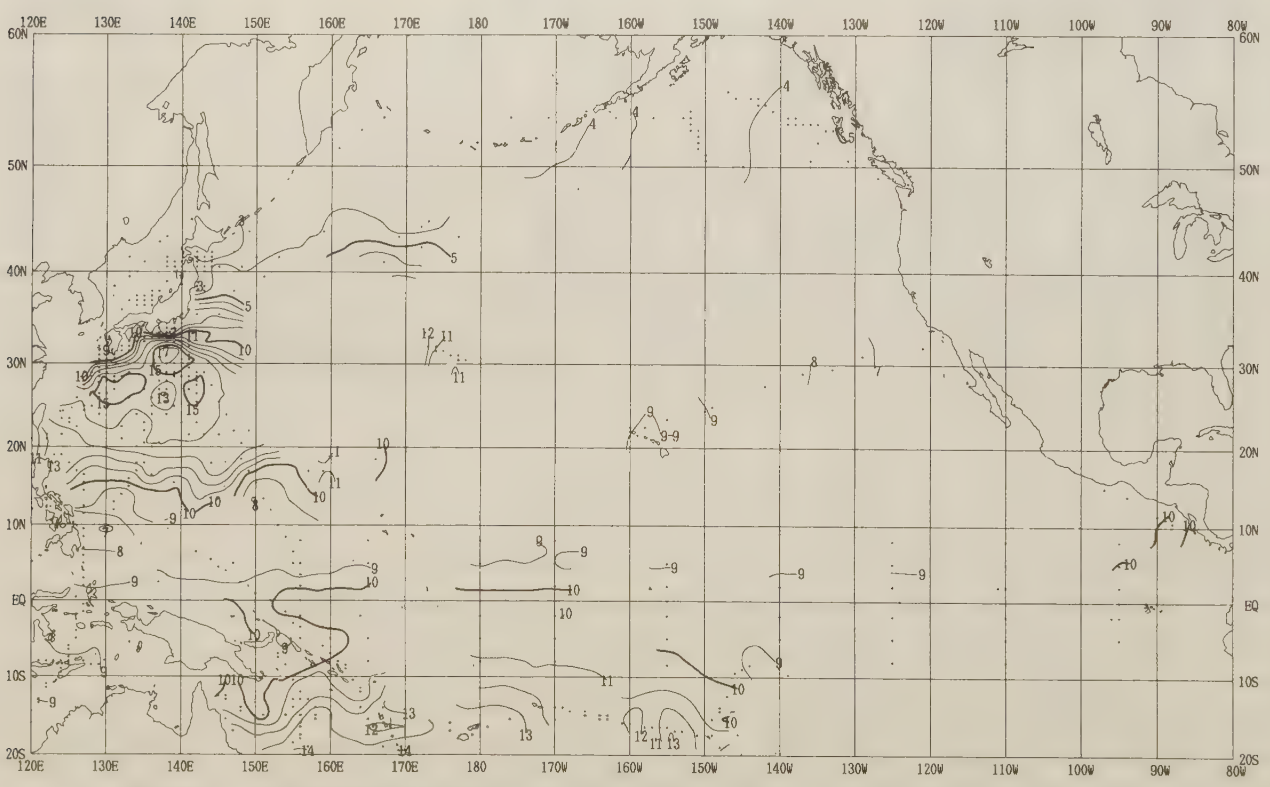
第17図　太平洋表層水温(深さ100m)図 (1997年 3月)

Fig.17 Subsurface (100m) temperatures in the Pacific Ocean for MAR 1997.
Contour interval is 1°C. Observation points are denoted by dots.



第18図　太平洋表層水温(深さ200m)図 (1997年 3月)

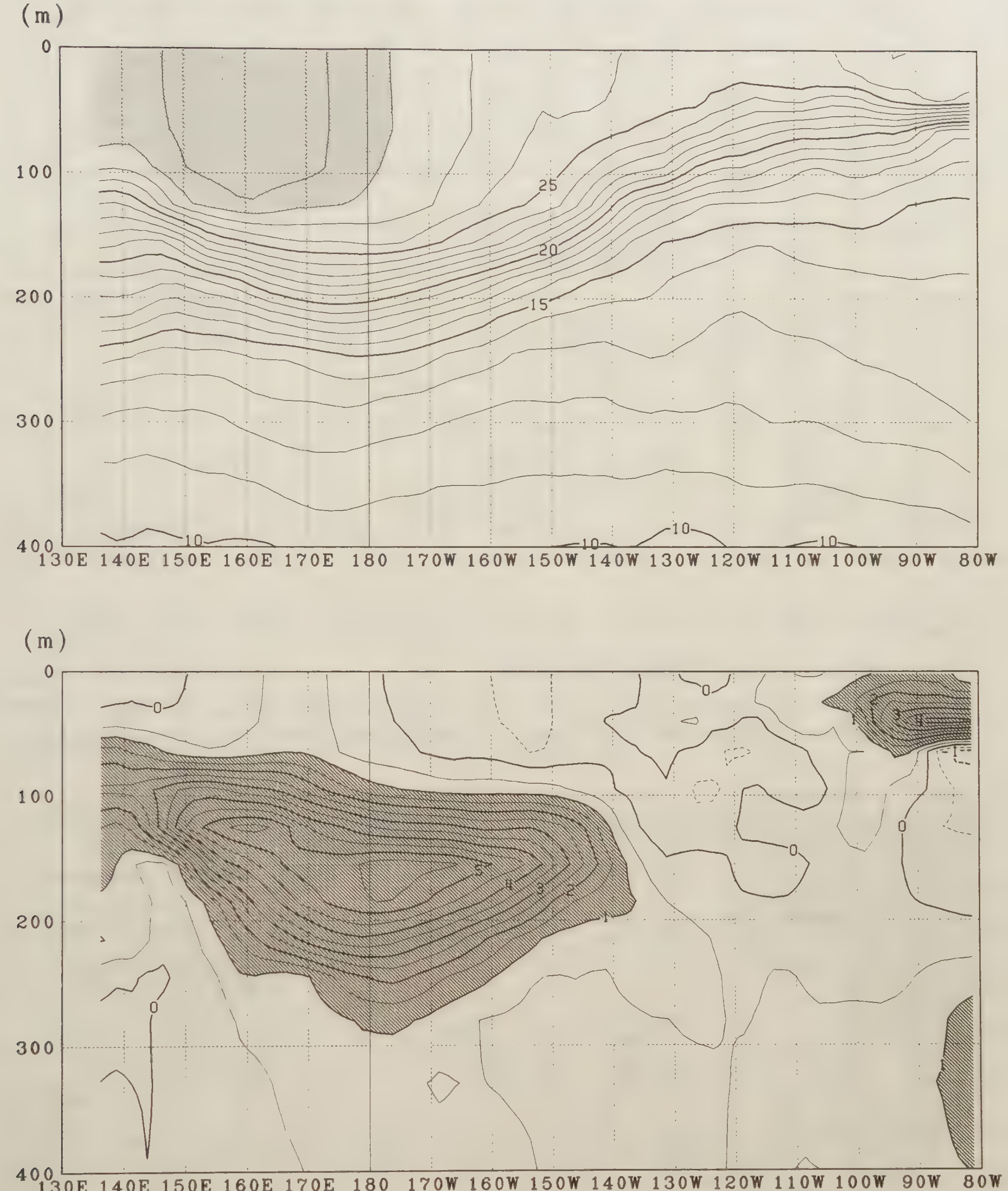
Fig.18 Subsurface (200m) temperatures in the Pacific Ocean for MAR 1997. Contour interval is 1°C. Observation points are denoted by dots.



第19図　太平洋表層水温(深さ400m)図 (1997年 3月)

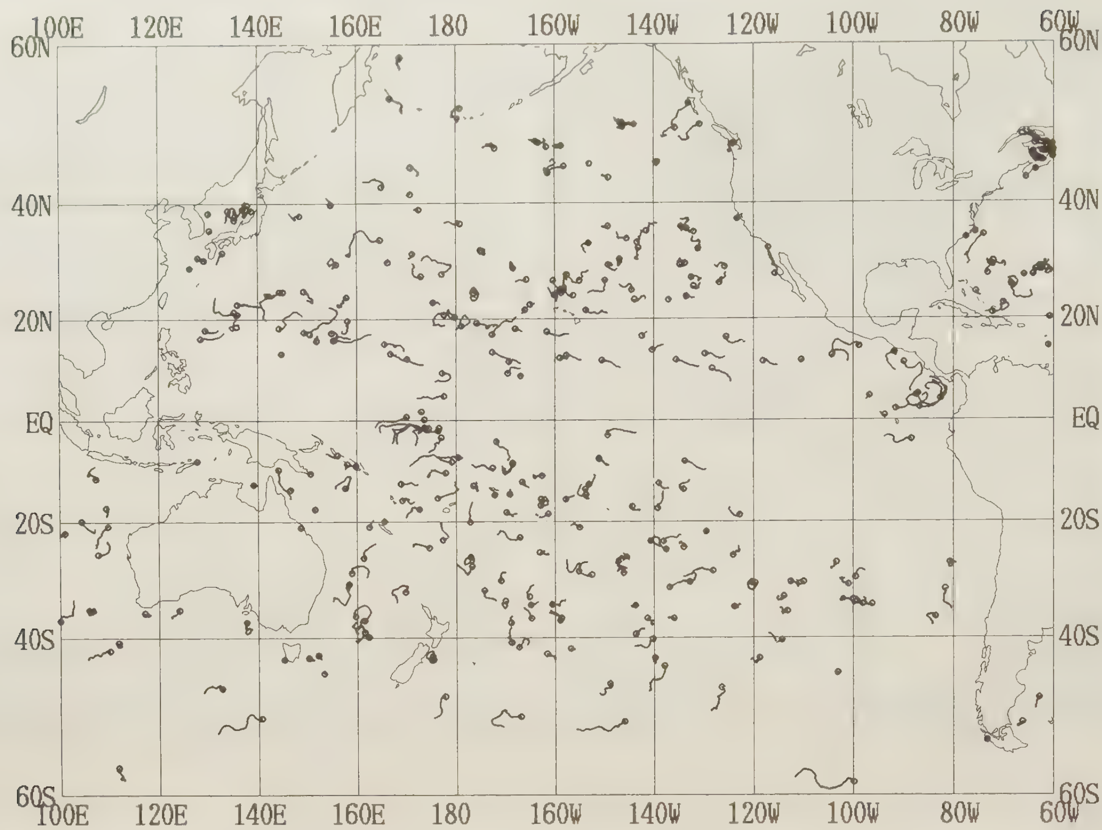
Fig.19 Subsurface (400m) temperatures in the Pacific Ocean for MAR 1997. Contour interval is 1°C. Observation points are denoted by dots.

Depth-Longitude Sections of Equatorial Temperature & Anomalies



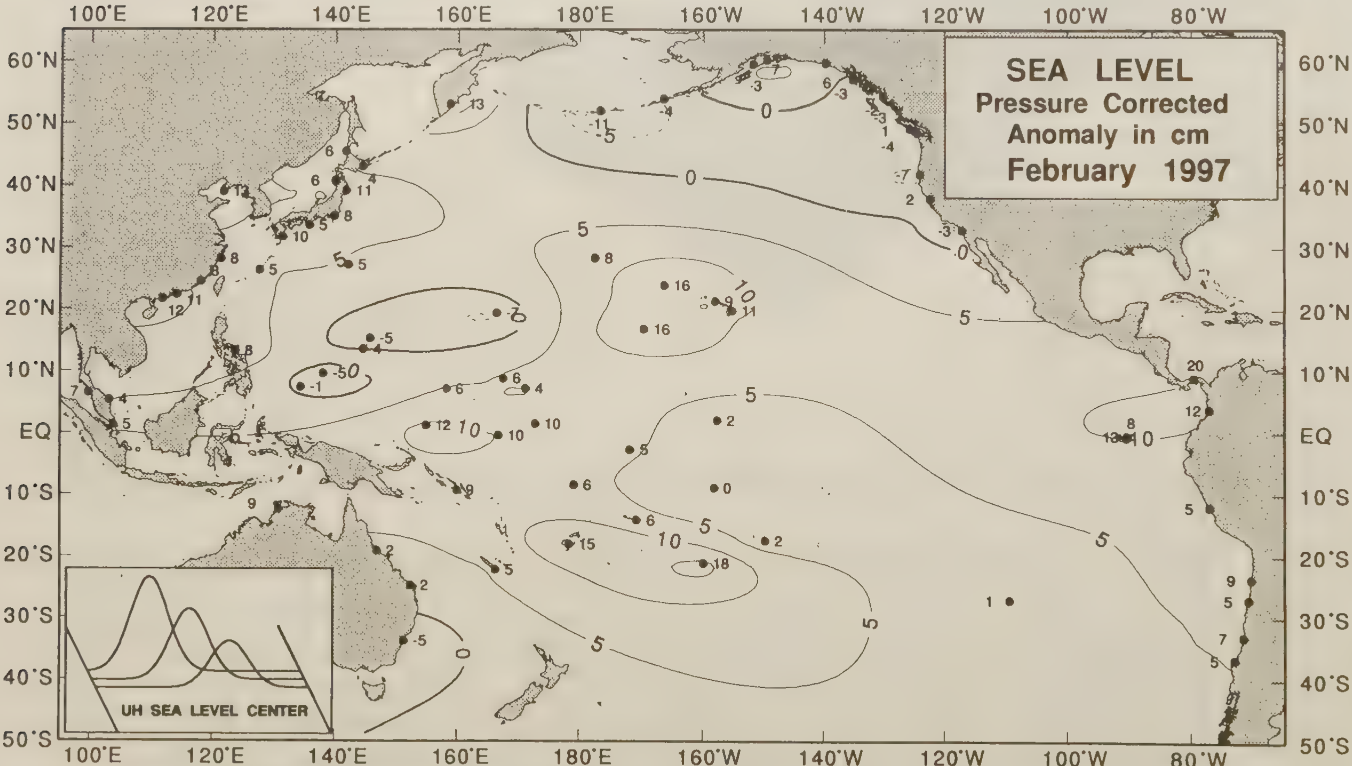
第20図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1997年 3月）

Fig.20 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for MAR 1997. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in top panel are shaded. In bottom panel values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1995 base period means.



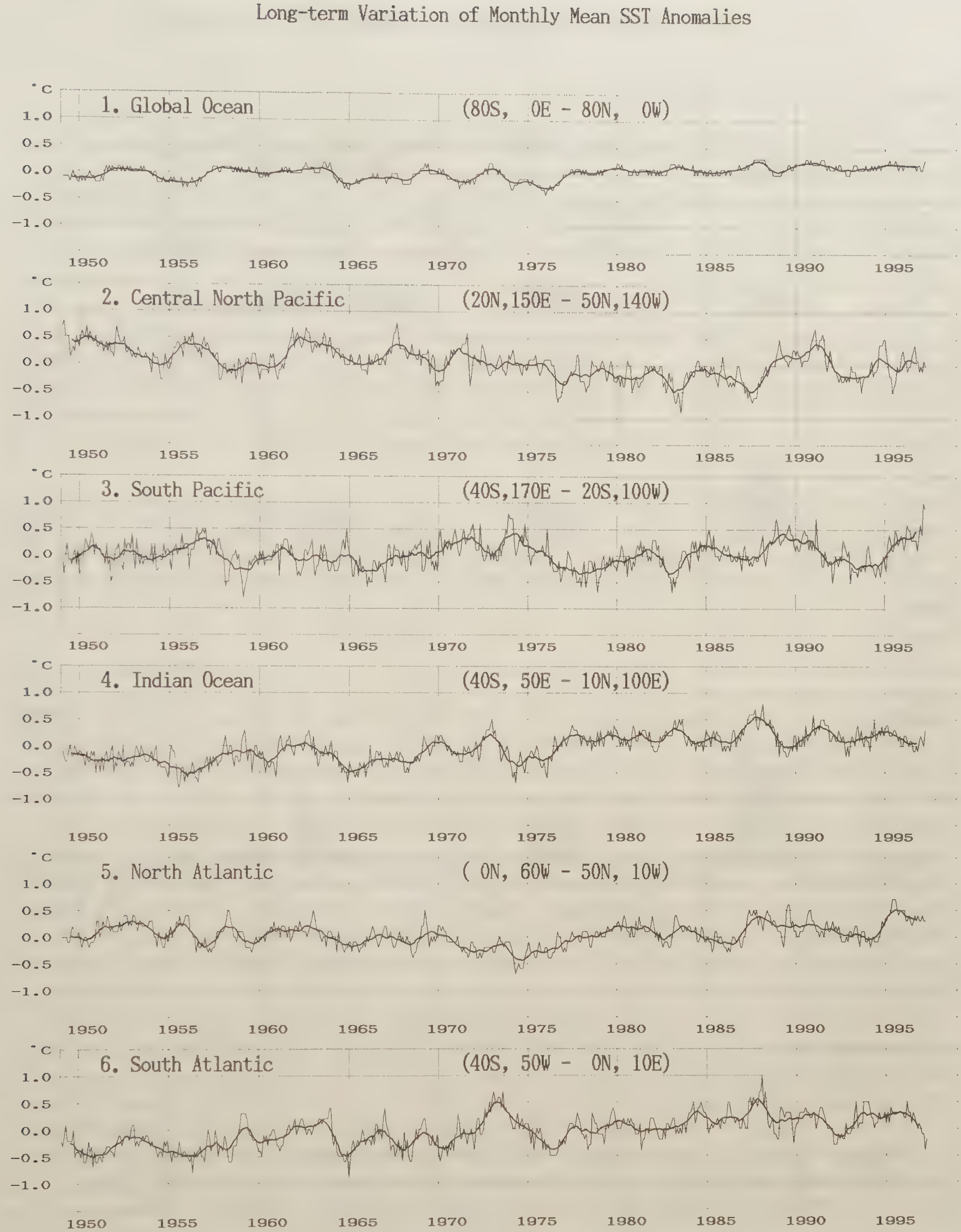
第21図　太平洋ブイ流跡図(1997年 3月)

Fig.21 Movements of drifting buoys in the Pacific Ocean during MAR 1997.
Each track is for one buoy. Small circles represent last positions for the month.



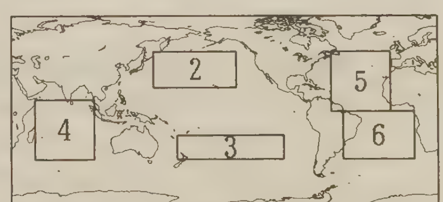
第22図　太平洋海面水位偏差図 (1997年 2月)

Fig.22 Monthly sea level anomalies for FEB 1997 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Dept. of Oceanography, Univ. of Hawaii.

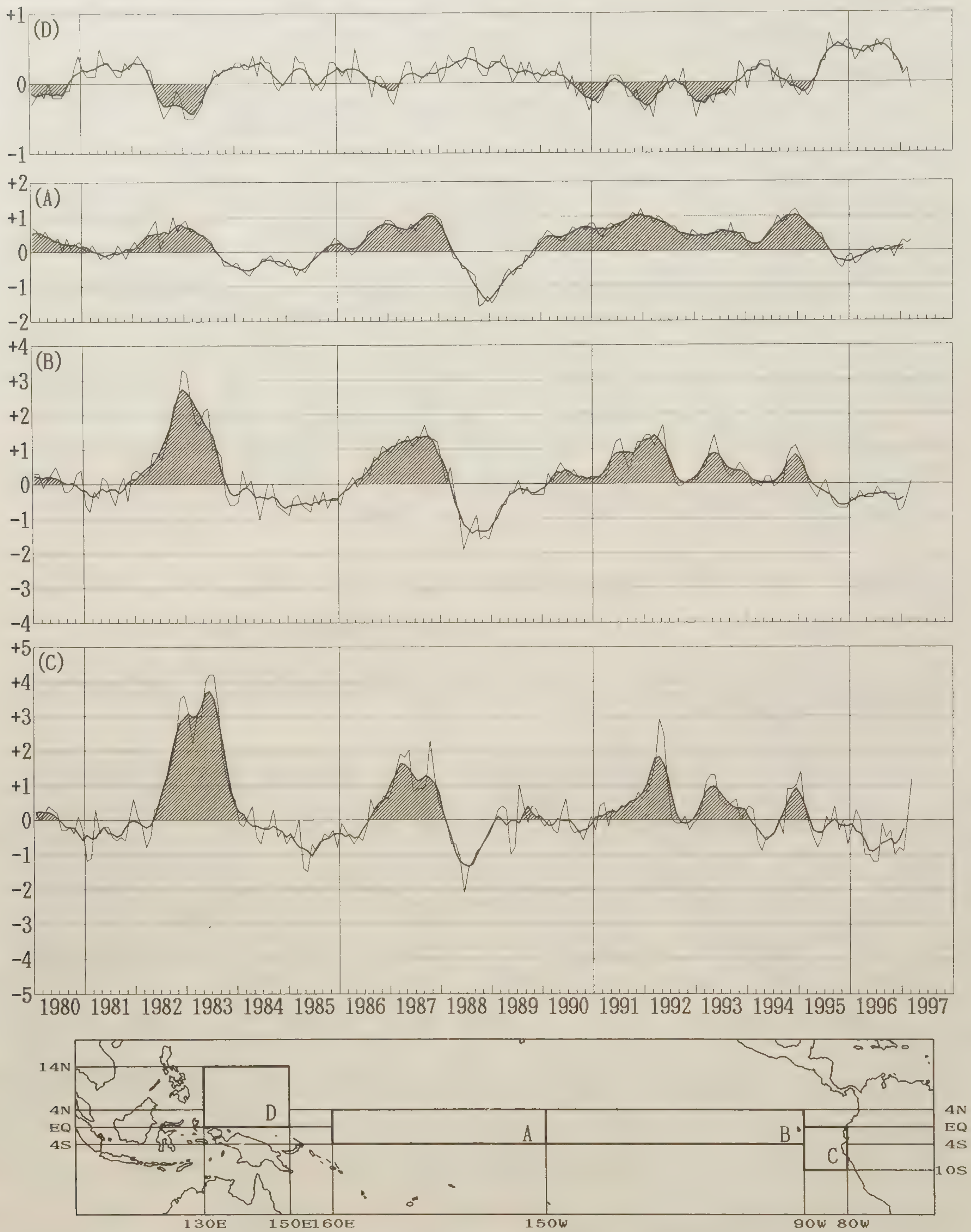


第23図 海域平均海面水温偏差の長期変動

Fig.23 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.



Time Series of Equatorial Pacific SST Anomalies



第24図　太平洋赤道域の海面水温偏差時系列図

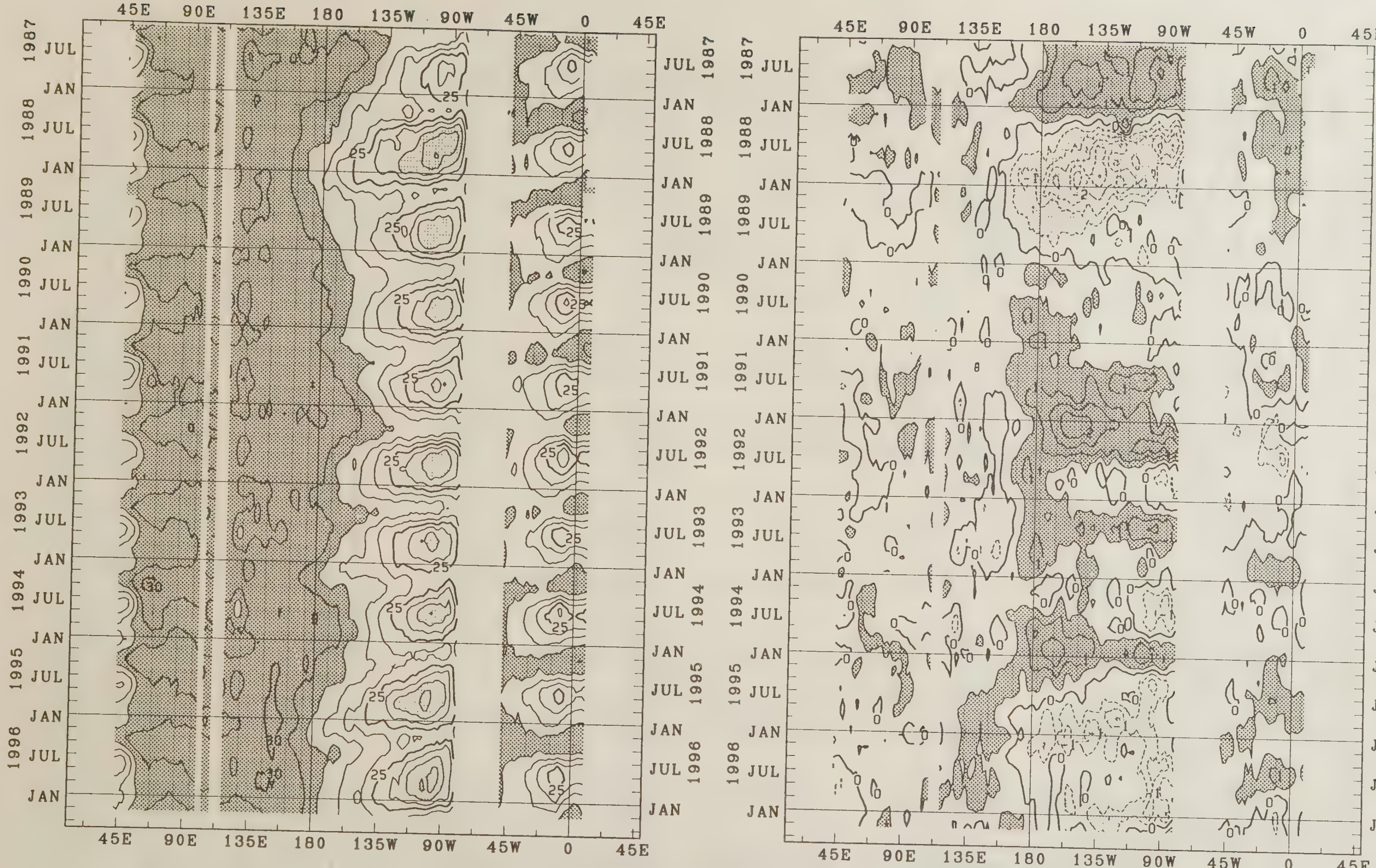
Fig.24 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom.
Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

El Nino Monitoring Indices

MONTH	SEA SURFACE TEMPERATURE AND ANOMALY (°C) REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	SEA LEVEL PRESSURE ANOMALY (hPa) TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 95	28.3	-0.2	29.0	1.0	26.2	0.8	25.7	1.4	-0.4	-0.3	0.6
FEB 95	28.2	-0.1	28.9	0.9	26.8	0.6	26.1	0.4	-0.2	0.6	1.1
MAR 95	28.2	-0.2	28.8	0.7	26.9	0.0	25.8	-0.1	0.4	0.3	-0.5
APR 95	28.7	-0.1	28.8	0.6	26.9	-0.2	24.6	-0.5	-1.4	-1.6	-0.0
MAY 95	29.2	0.1	29.0	0.5	26.2	-0.4	23.1	-0.8	-1.0	-0.7	0.6
JUN 95	29.6	0.3	29.0	0.5	26.0	-0.1	22.2	-0.5	-0.1	0.3	0.4
JUL 95	29.5	0.3	28.7	0.2	25.3	0.1	21.7	0.1	0.4	0.4	-0.4
AUG 95	29.8	0.7	28.4	0.0	24.3	-0.3	20.5	-0.1	0.0	0.4	0.3
SEP 95	29.7	0.5	28.1	-0.2	24.0	-0.6	20.7	0.4	0.2	0.4	-0.0
OCT 95	29.8	0.5	28.0	-0.4	23.9	-0.7	20.4	-0.3	-0.3	-0.7	-0.5
NOV 95	29.7	0.5	27.9	-0.5	23.9	-0.7	21.5	0.0	0.1	0.1	-0.1
DEC 95	29.5	0.6	28.0	-0.2	24.2	-0.7	21.9	-0.7	-0.5	-0.9	0.0
JAN 96	29.0	0.5	27.9	-0.1	25.0	-0.4	24.1	-0.2	0.8	1.0	-0.7
FEB 96	28.6	0.3	27.6	-0.4	25.7	-0.5	26.0	0.3	0.1	-0.2	-0.5
MAR 96	28.8	0.4	27.8	-0.3	26.7	-0.2	25.9	0.0	0.7	1.0	-0.3
APR 96	29.3	0.5	28.1	-0.1	26.7	-0.4	24.1	-1.0	0.8	0.5	-0.5
MAY 96	29.6	0.5	28.5	0.0	26.2	-0.4	22.9	-1.0	0.3	1.2	1.2
JUN 96	29.7	0.4	28.6	0.1	25.7	-0.4	21.5	-1.2	1.4	1.6	-0.2
JUL 96	29.8	0.6	28.4	-0.1	25.1	-0.1	20.4	-1.2	0.7	0.6	-0.6
AUG 96	29.6	0.5	28.4	0.0	24.3	-0.3	20.5	-0.1	0.4	0.4	-0.3
SEP 96	29.8	0.6	28.4	0.1	24.3	-0.3	19.8	-0.5	0.5	-0.7	-1.7
OCT 96	29.9	0.6	28.5	0.1	24.3	-0.3	20.4	-0.3	0.4	-0.1	-0.8
NOV 96	29.5	0.3	28.2	-0.2	24.3	-0.3	20.5	-1.0	-0.0	-0.5	-0.5
DEC 96	29.2	0.3	28.3	0.1	24.1	-0.8	21.8	-0.8	0.8	-0.3	-1.9
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9

第1表　エルニーニョ監視指数

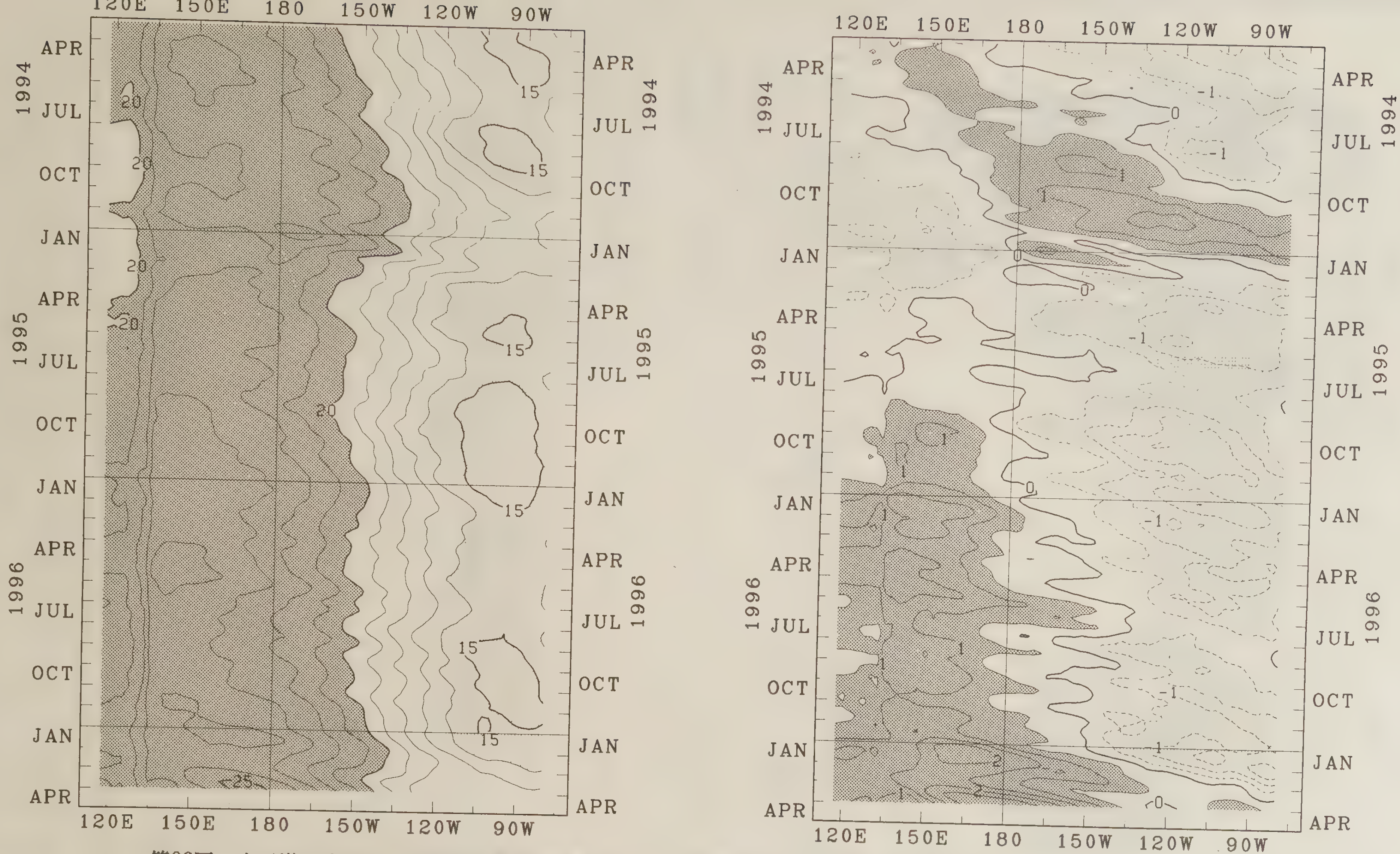
Table 1　El Nino Monitoring indices



第 25 図 赤道に沿った海面水温（左）および偏差（右）の時間-経度断面図

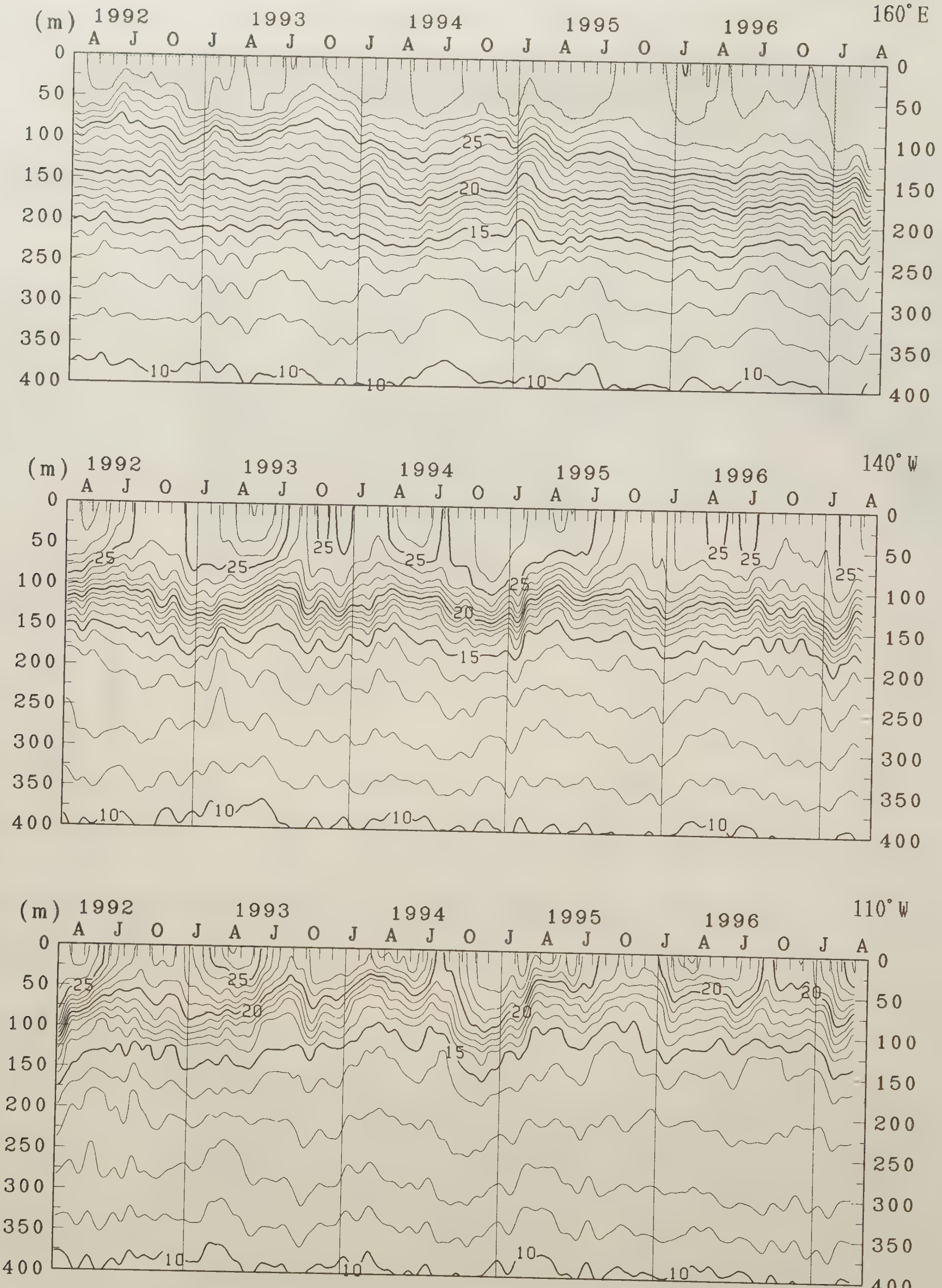
Fig.25 Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2 °N-2 °S) in the global ocean. Contour interval is 1 °C (left) and 0.5 °C (right). Values in the left panel greater than 28 °C are shaded and values less than 23 °C are spotted. Dashed contours in right panel indicate negative anomalies. Anomalies are computed from 1961-1990 base period means.

Time-Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第26図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

Fig.26 Time-longitude sections of ocean heat content in the upper 260m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values in the left panel greater than 20°C are shaded and values less than 16°C are spotted. Dashed contours in right panel indicate negative anomalies. Anomalies are computed from 1987-1995 base period means.



第27図　太平洋赤道域の表層水温の時間－深度断面図

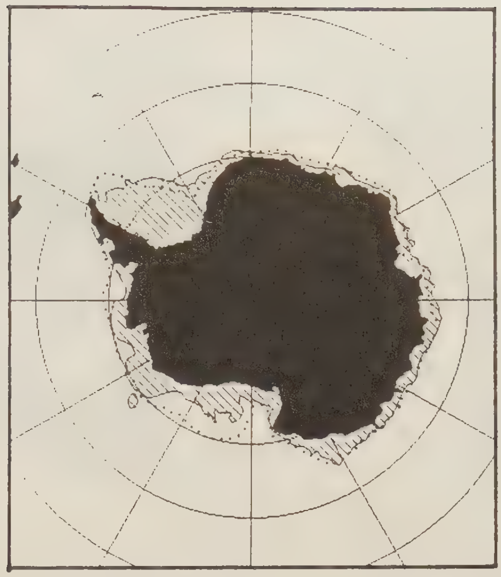
(上：西部、中：中部、下：東部)

Fig.27 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.



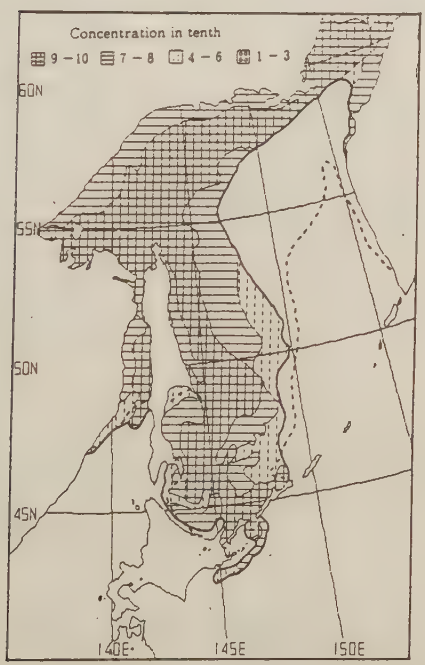
第28-1図　北極域の海氷図（1997年 3月14日）

Fig. 28-1 Sea ice chart in the Arctic on 14 MAR. 1997. The area hatched represents the sea ice extent. The dotted line denotes the mean ice edge (averaged for the period from 1972 through 1990). The data source is the U. S. National Ice Center (USA).



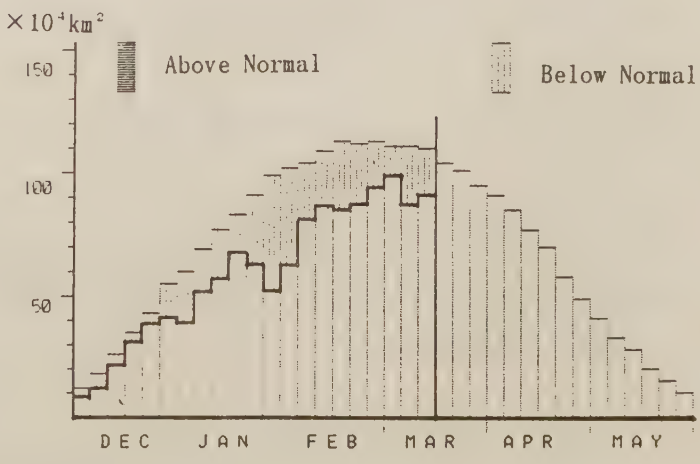
第28-2図　南極域の海氷図（1997年 3月14日）

Fig. 28-2 Sea ice chart in the Antarctic on 14 MAR. 1997. The area hatched represents the sea ice extent. The dotted line denotes the mean ice edge (averaged for the period from 1972 through 1990). The data source is the U. S. National Ice Center (USA).



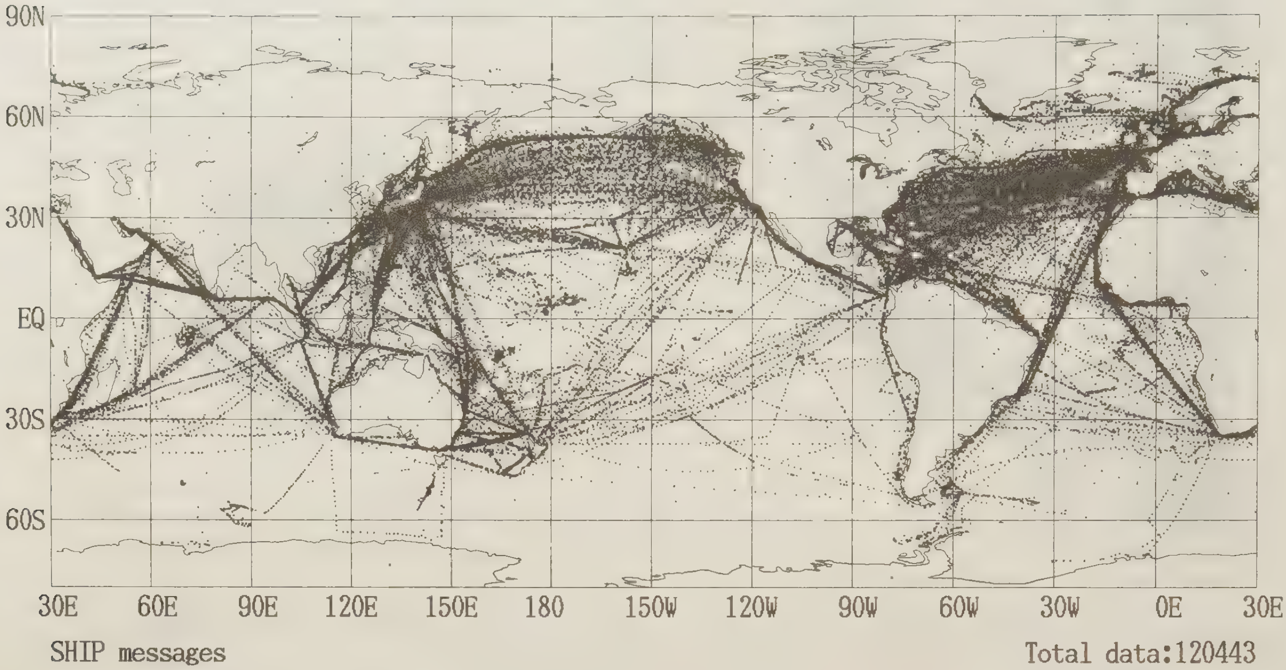
第28-3図　オホーツク海の海氷図（1997年 3月15日）

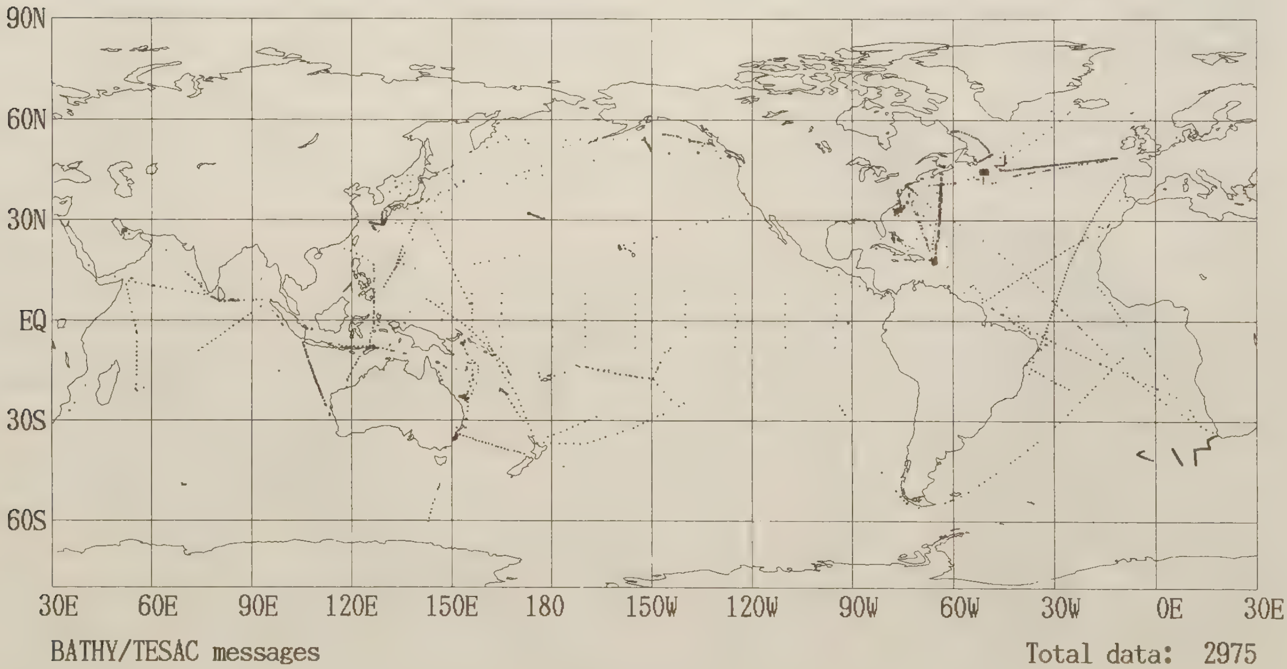
Fig. 28-3 Sea ice chart in the Sea of Okhotsk on 15 MAR. 1997. The dotted line denotes mean ice edge (averaged for the period from 1972 through 1990).



第28-4図　オホーツク海半旬海氷域面積（1996/97）

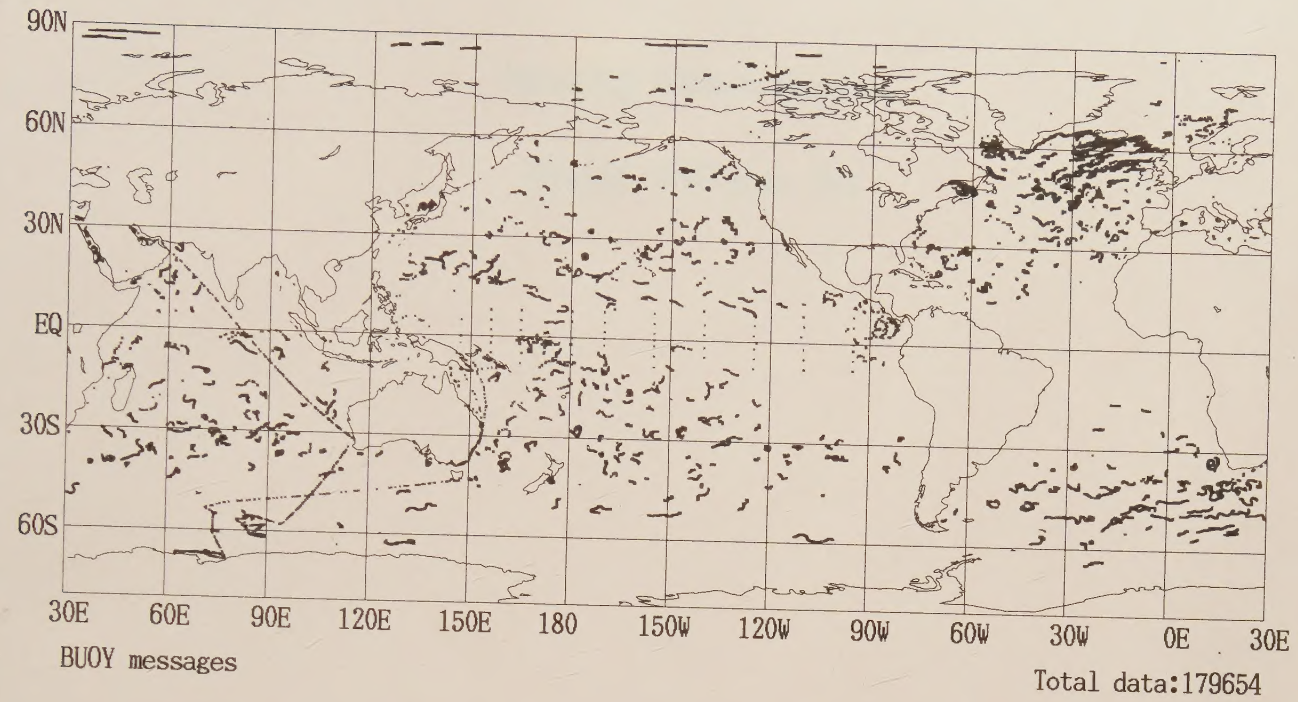
Fig. 28-4 Time-series of 5-day sea ice extent in the Sea of Okhotsk (1996/97).

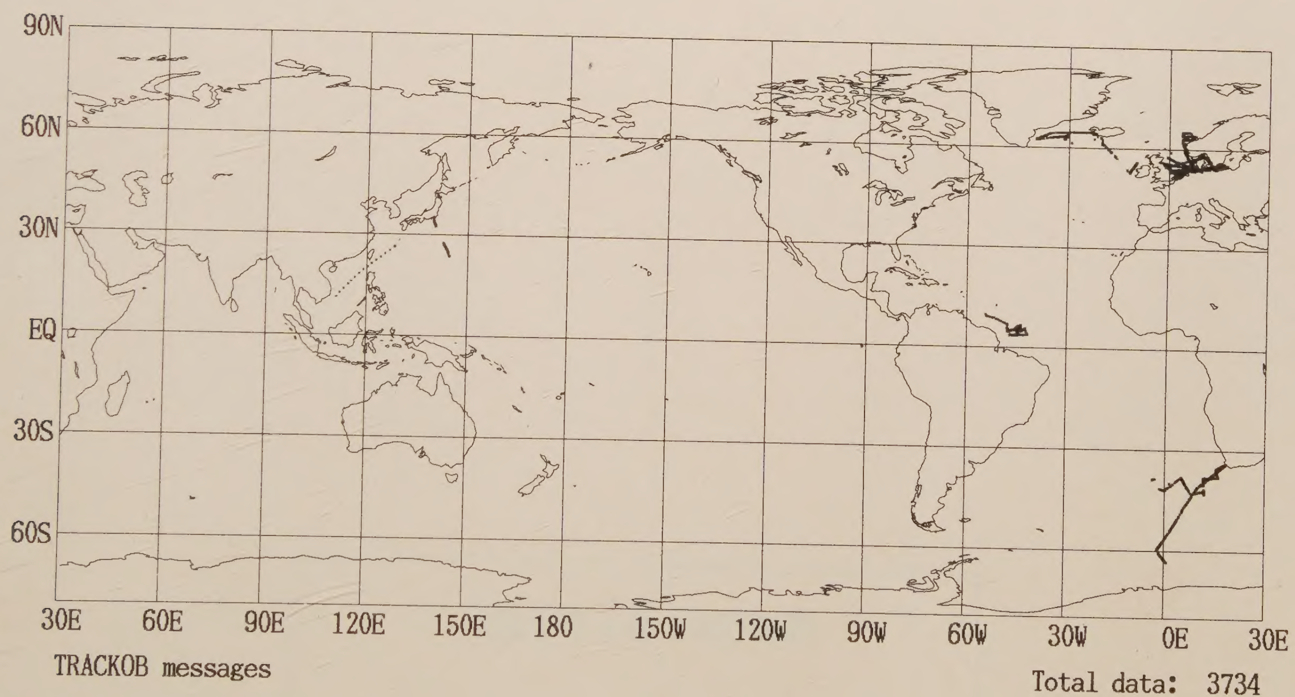




第29-1図　測点分布図(1997年 3月)

Fig.29-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for MAR 1997.





第29-2図　測点分布図(1997年 3月)

Fig.29-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for MAR 1997.

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